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AN 01-60JE-1

PILOT'S FLIGHT OPERATING INSTRUCTIONS

ARMY MODEL
P-51-D-5

BRITISH MODEL
MUSTANG IV

AIRPLANES

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This publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

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APRIL 5, 1944

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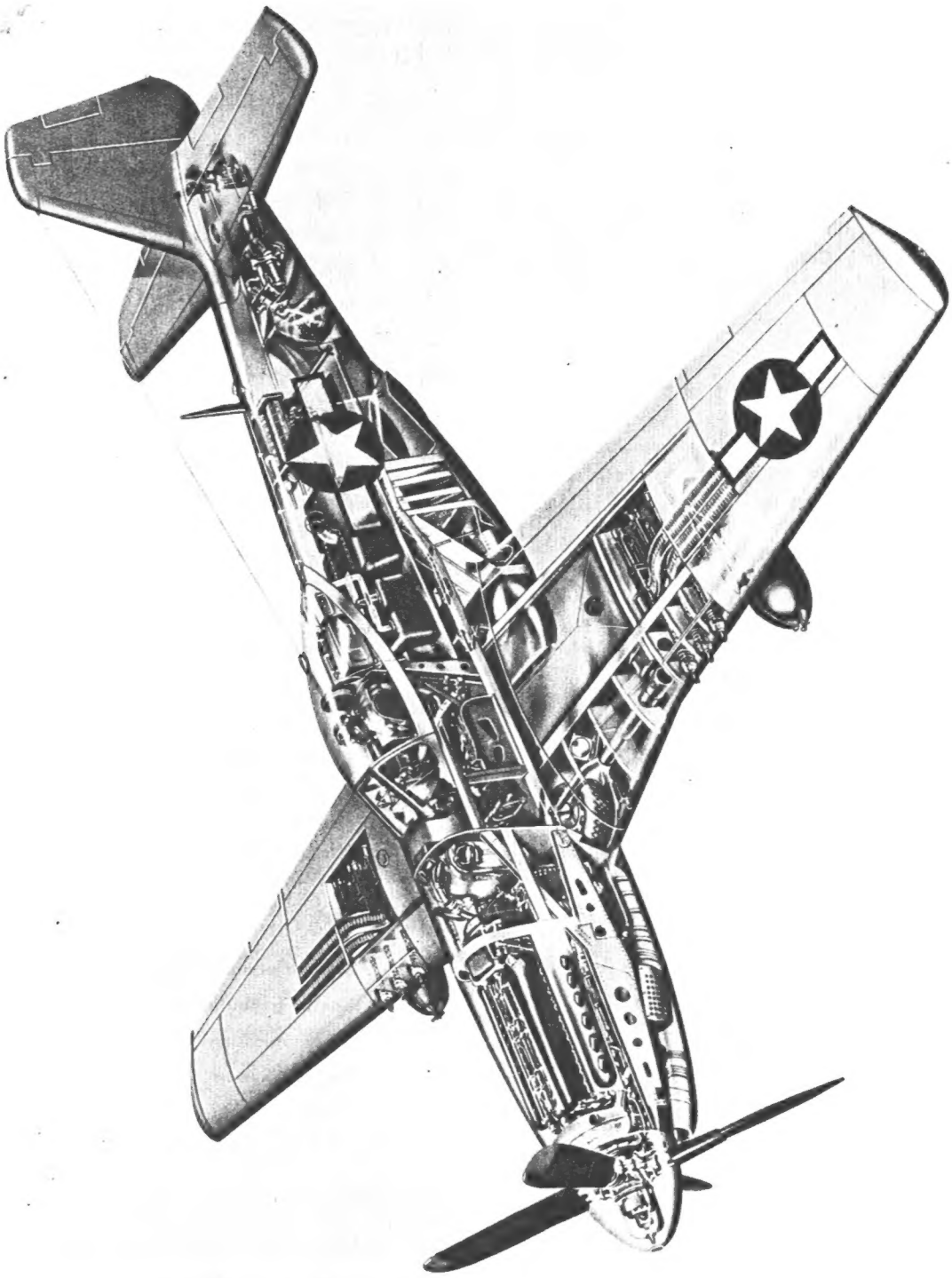


SECTION I

Description

1. GENERAL.

The North American P-51D Fighter Airplane is a single-place, low-wing monoplane powered by a V-1650-7 liquid-cooled engine. It has a wing span of 37 feet, a length of 32 feet 3 inches, and a height (tail down) of 12 feet, 2 inches. The airplane is armed with six .50-caliber machine guns and may be equipped with wing racks to carry bombs, depth charges, chemical tanks, or fuel tanks. The armor plate protection is shown in figure 8.

2. FLIGHT CONTROLS.

The ailerons, elevators, and rudder are conventionally operated by a control stick and rudder pedals. Trim tab controls (a wheel for the elevator tabs and knobs for the rudder and aileron tabs) and the flap control lever are on the control pedestal at the left side of the cockpit. A surface control locking gear is forward of the base of the control stick.

3. LANDING GEAR.

a. GENERAL.—The control lever for the hydraulically operated landing gear is on the left side of the cockpit. When the surface control stick is pulled back, the tail wheel is linked to the rudder cables and is steerable 6 degrees right or left. With the control stick forward, the tail wheel is unlocked and full swiveling.

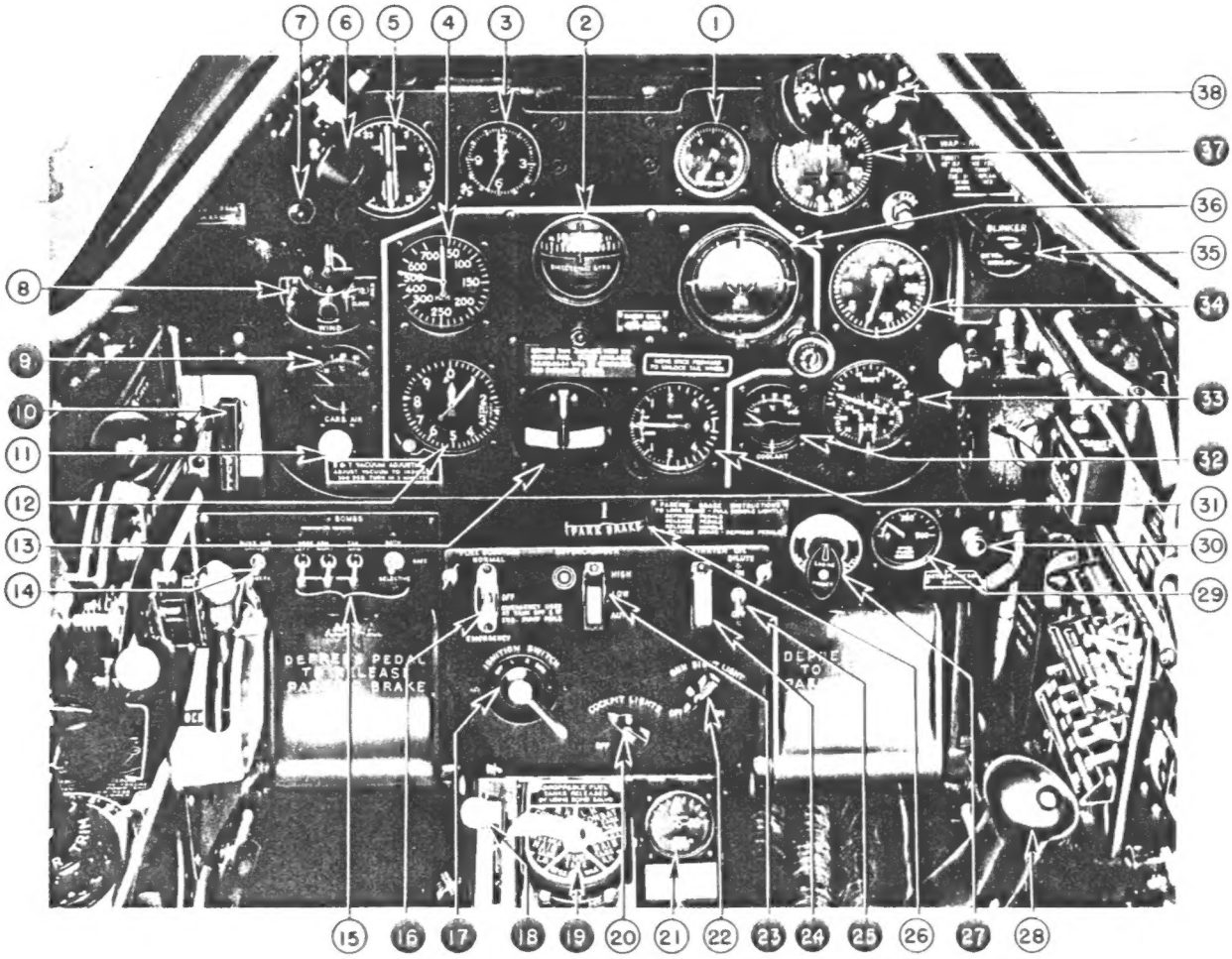
WARNING

Do not move the landing gear control when airplane is on the ground, as there is no safety mechanism to prevent the gear from retracting.

b. LANDING GEAR WARNING LIGHT.—A red-jeweled light on the left side of the instrument panel will illuminate when the throttle is retarded with the landing gear not locked in the down position. A push-button switch for testing the lamp is adjacent to the warning light.

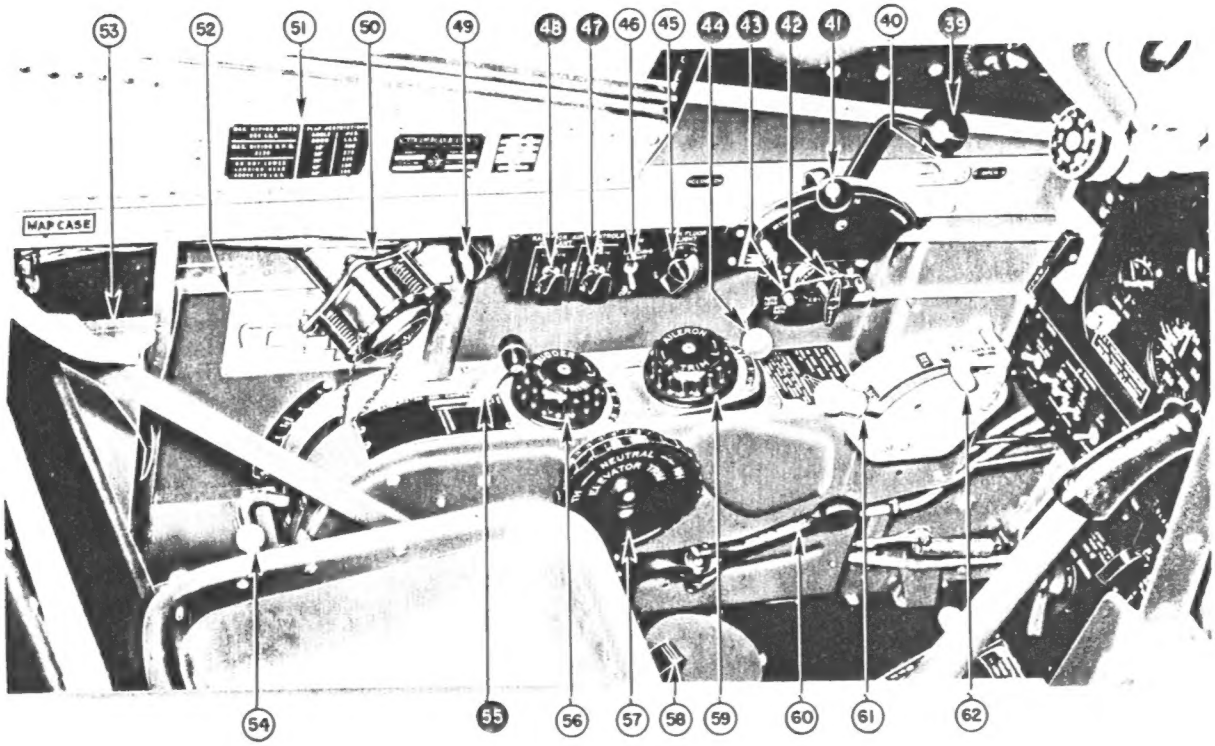
4. BRAKES.

The multiple-disc brakes are hydraulically operated. Fluid for the brake system is obtained from the hydraulic reservoir. A standpipe in the reservoir reserves a supply of fluid for brake operation in case fluid for the hydraulic system is lost. The parking brake control is just below the center of the instrument panel. See figure 5 for brake system diagram.



1. Suction Gage
2. Directional Gyro
3. Clock
4. Airspeed Indicator
5. Remote Reading Compass Indicator
6. Fluorescent Light
7. Landing Gear Warning Light
8. Remote Contactor
9. Carburetor Air Temperature Indicator
10. Boost Control
11. Bank-and-Turn Vacuum Adjustment Knob
12. Altimeter
13. Bank-and-Turn Indicator
14. Gun and Camera Safety Switch
15. Bomb Control Switches
16. Booster Pump Switch
17. Ignition Switch
18. Fuel Shut-off Control
19. Fuel Selector Control
20. Cockpit Light Switch
21. Hydraulic Pressure Gage
22. Gun Sight Rheostat
23. Supercharger Control Switch
24. Starter Switch
25. Oil Dilution Switch
26. Parking Brake Handle
27. Engine Primer
28. Control Stick
29. Oxygen Pressure Gage
30. Oxygen System Warning Light
31. Rate-of-Climb Indicator
32. Coolant Temperature Indicator
33. Oil Temperature and Fuel and Oil Pressure Gage
34. Tachometer
35. Oxygen Flow Blinker
36. Flight Indicator
37. Manifold Pressure Gage
38. Fluorescent Light

Figure 2—Cockpit—Forward View



39. Throttle
40. Throat Microphone Switch
41. Propeller Control
42. Throttle Friction Lock
43. Propeller and Mixture Control Friction Lock
44. Mixture Control
45. Left-hand Fluorescent Light Switch
46. Landing Light Switch
47. Oil Cooler Exit Flap Control Switch
48. Coolant Radiator Exit Flap Control Switch
49. Cockpit Light
50. Pyrotechnic Pistol Mount
51. Airplane Restriction Plate
52. Fuel System Diagram
53. Map Case
54. Wing Flap Control
55. Carburetor Air Control
56. Rudder Trim Tab Control
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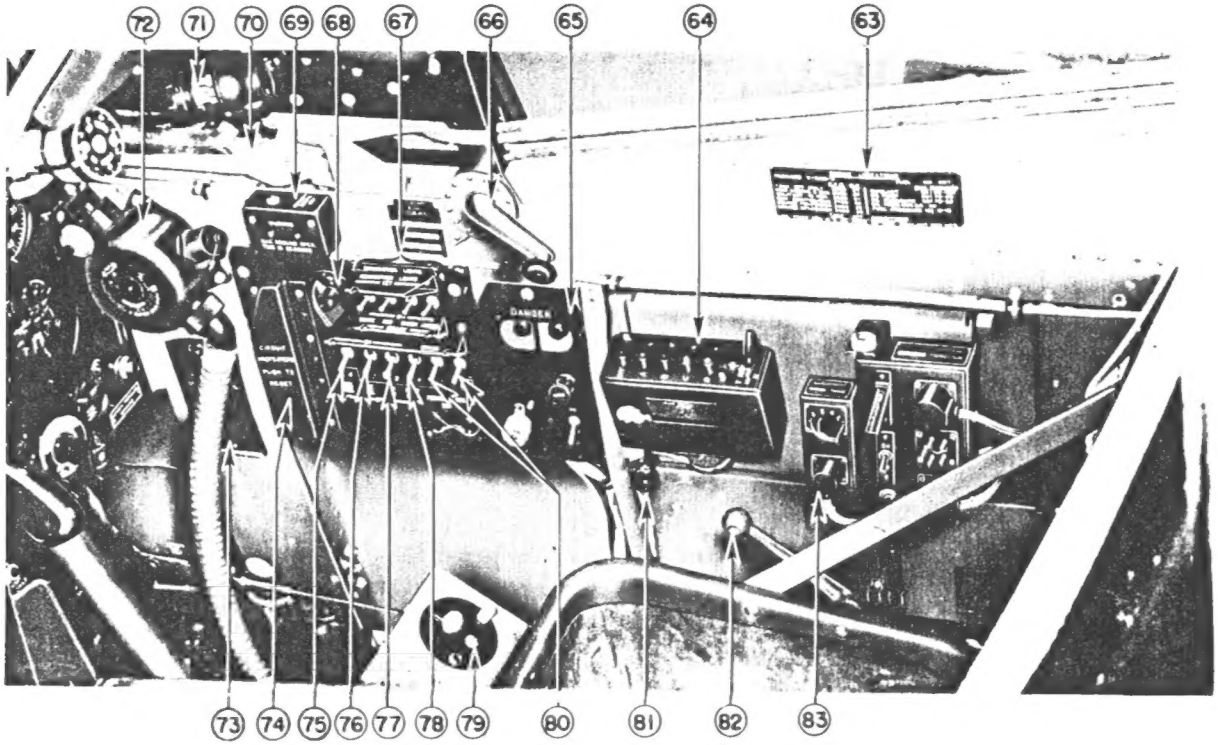
60. Landing Gear Control
61. Bomb Control Handle
62. Bomb Antisalvo Guard

Figure 3—Cockpit—Left Side



63. Engine Limitations Plate
64. SCR-522 Radio Control Box
65. Detonator Switches
66. Canopy Handcrank
67. Recognition Light Switches
68. Right-hand Fluorescent Light Switch
69. Recognition Lights Keying Switch
70. Canopy Emergency Release Handle
71. Fluorescent Light
72. Oxygen Regulator
73. Spare Lamp Stowage
74. Circuit Breaker Reset Guard
75. Generator-disconnect Switch
76. Battery-disconnect Switch
77. Gun Heater Switch
78. Pitot Heater Switch
79. Detrola Receiver
80. Position Light Switches
81. Cockpit Light
82. Seat Adjustment Handle
83. SCR-695 Radio Control Box

Figure 4—Cockpit—Right Side

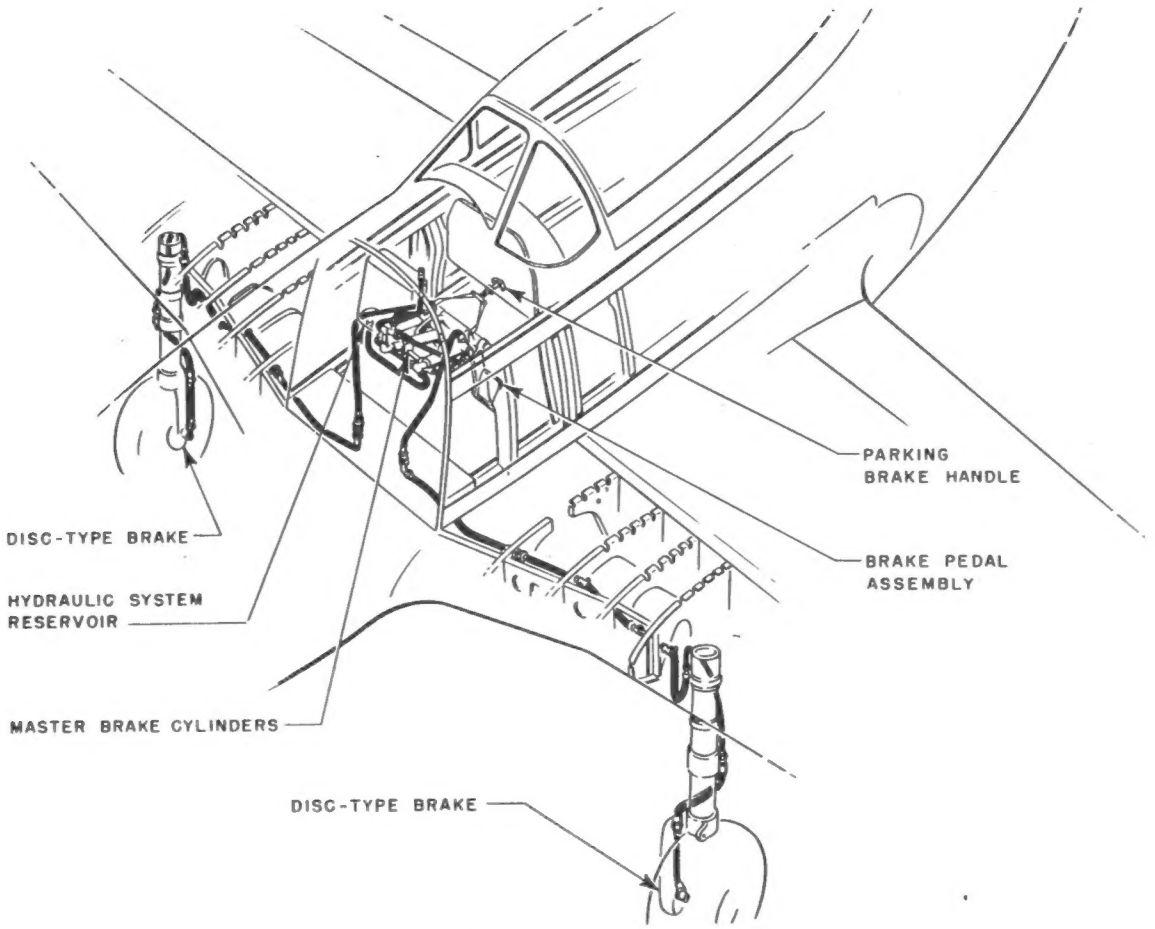


Figure 5—Brake System

5. HYDRAULIC SYSTEM.

The hydraulic system *(see figures 6 and 7)* operates the landing gear and wing flaps. The wing flaps are preselectively set by moving the control lever, on the aft end of the control pedestal, to the desired flap setting. The flaps are automatically held in that position until another flap setting is selected. No emergency hydraulic hand-pump is provided.

6. POWER PLANT.

a. ENGINE.—The Packard built Rolls Royce, V-1650-7, twelve-cylinder engine incorporates a two-speed, two-stage supercharger and is equipped with an injection-type carburetor and an automatic manifold pressure regulator. An aneroid switch automatically controls the supercharger shift. Low blower ratio is 5.8:1 and high blower ratio is 7.3 to 1. Field modification kits are available to change supercharger gear ratios, converting V-1650-7 to V-1650-3.

b. FUEL, OIL, AND COOLANT.

Fuel	Spec. AN-F-28, Grade 100/130
Oil	Spec. AN-O-5, Grade 1100
Coolant	70% water and 30% ethylene glycol (Spec. AN-E-2) treated with NaMBT

c. ENGINE CONTROLS.—The engine control quadrant has two friction locks, one for the throttle and one for the propeller and mixture controls. The three mixture control positions are: "IDLE CUT OFF," "AUTO LEAN," and "AUTO RICH."

d. CARBURETOR AIR.—The air induction system supplies either ram air or unrammed, filtered air to the carburetor. The control handle for the system is at the pilot's left. Whenever the air duct becomes obstructed, emergency

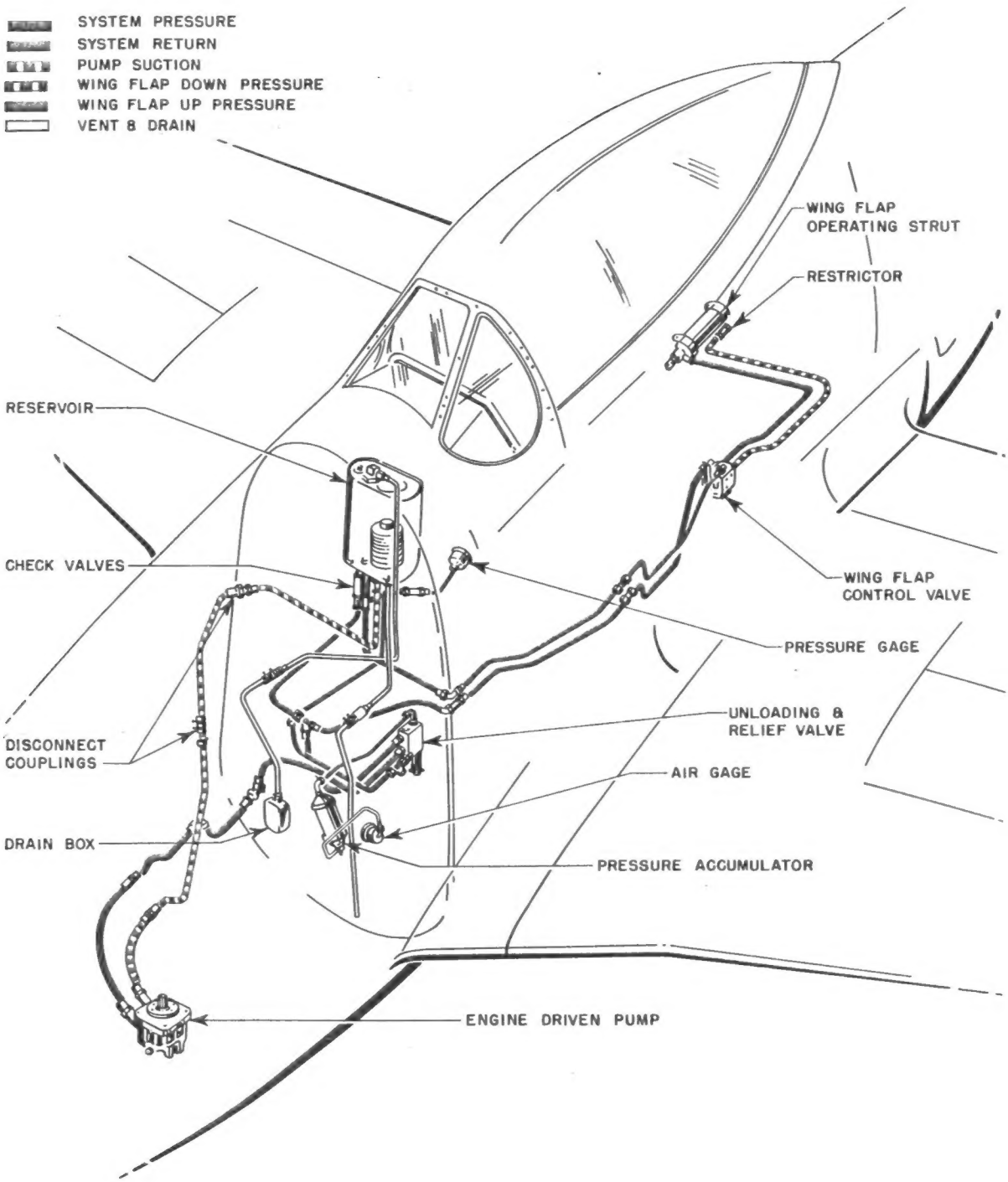


Figure 6—Hydraulic Power and Wing Flap Systems

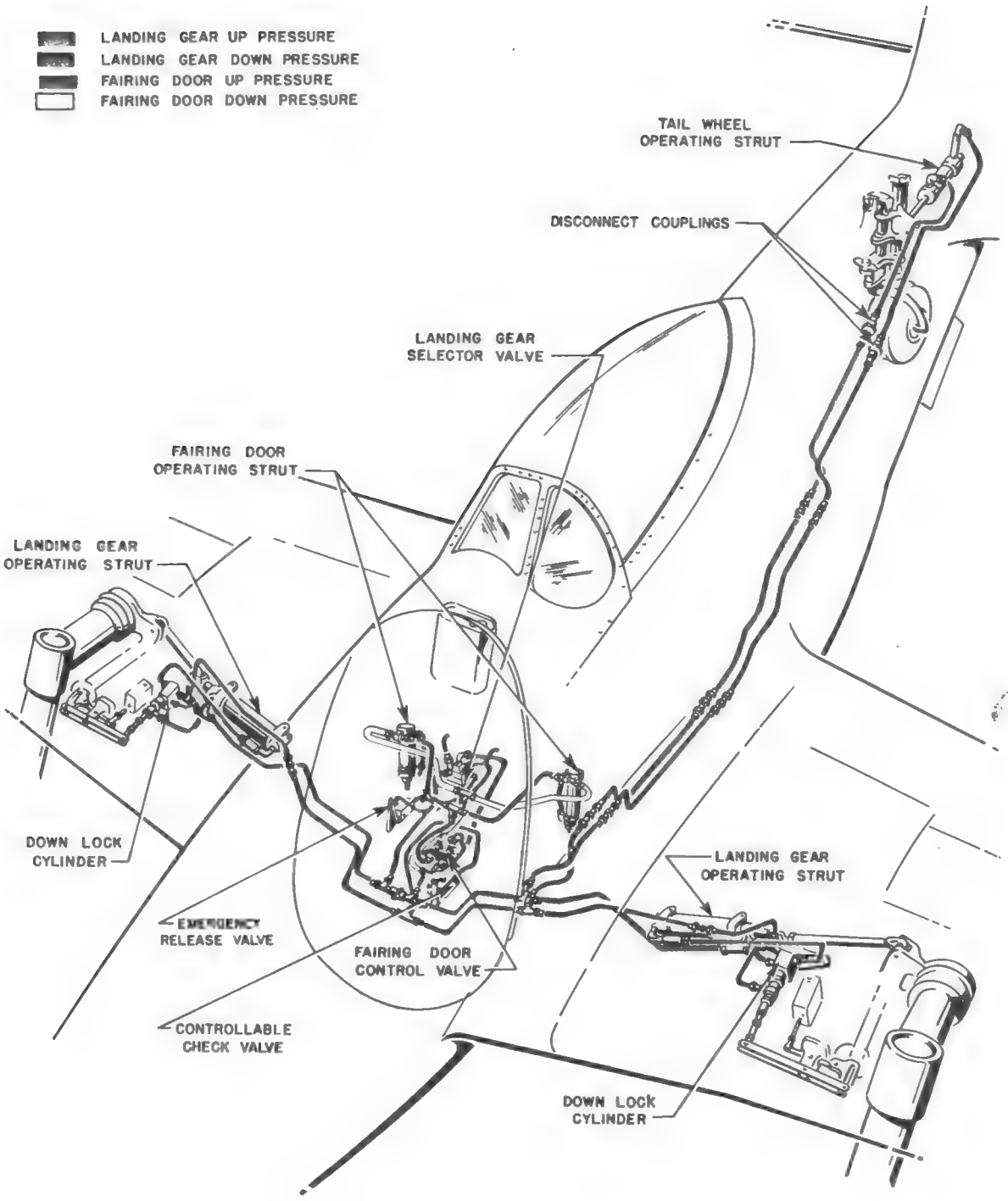


Figure 7—Hydraulic Landing Gear System

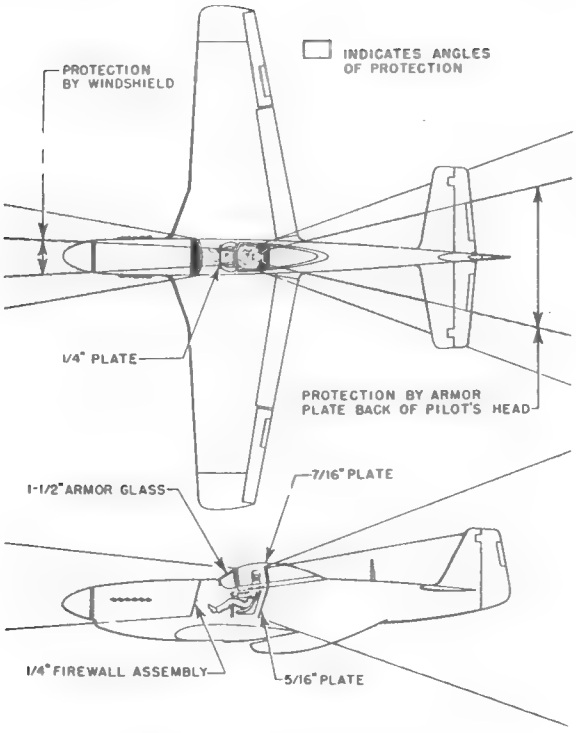


Figure 8—Armor Protection

doors will automatically open to allow engine compartment air to enter the carburetor.

e. PROPELLER.—The airplane is equipped with a Hamilton Standard, four-blade, hydraulically operated constant-speed propeller, 11 feet 2 inches in diameter. The pitch settings are 23° low, 65° high.

7. FUEL SYSTEM.

Two self-sealing fuel tanks are carried in the wing, and an auxiliary 85-gallon, self-sealing tank is installed in the fuselage. The fuselage tank is located aft of the cockpit and is equipped with a goose-necked gage visible to the pilot. Two 75-gallon, pressurized combat tanks may be installed on the wing racks. Fuel flows as follows: from either of the wing tanks or the fuselage tank through a booster pump to the fuel selector valve; through the selector valve, shut-off valve, and fuel strainer to the engine-driven fuel pump; then to the carburetor. Fuel from the combat tanks flows through the selector valve into the main fuel line. All main fuel lines are self-sealing. See figure 9 for fuel system diagram.

NOTE

All airplanes equipped with 85-gallon fuselage fuel tanks may be identified by a white plus (+) sign printed below the serial number on the left-hand side of the fuselage.

8. OIL SYSTEM.

The oil tank is mounted on the forward face of the firewall. Scavenged oil flows from the engine to an oil cooler located in the lower section of the fuselage, beneath the cockpit. A thermostatically controlled air duct exit flap regulates the flow of air through the oil cooler. The oil dilution system is controlled by a switch on the upper right side of the pilot's switch panel. The oil system is shown in figure 10.

9. COOLING SYSTEMS.

The engine incorporates two cooling systems *(see figure 11)*: one cools the engine and the other cools the supercharger fuel-air mixture. Each system has a separate pump, expansion tank, and radiator. The two coolant radiators, constructed as a unit, are located in the air duct above and aft of the oil cooler. An air duct exit flap, thermostatically controlled by the temperature of the main cooling system, regulates the flow of air through the radiators.

10. ELECTRICAL SYSTEM.

The electrical system is a 24-volt direct-current type, receiving power from a 100-ampere engine-driven generator system supplemented with a 24-volt storage battery which supplies current when the generator system is inoperative. A single-wire direct current distribution system is used, the metallic structure of the airplane serving as a ground. An external power socket is located on the right side of the fuselage just behind the cockpit. External power should be used instead of the airplane battery to start the engine and operate the electrical system while the airplane is on the ground. An adapter for connecting the British type of external power supply is stowed adjacent to the external power socket. All of the electrical circuits are protected by either circuit breakers or circuit-breaker switches located on the right switch panel. See figures 2 and 4 for location of main electrical switches.

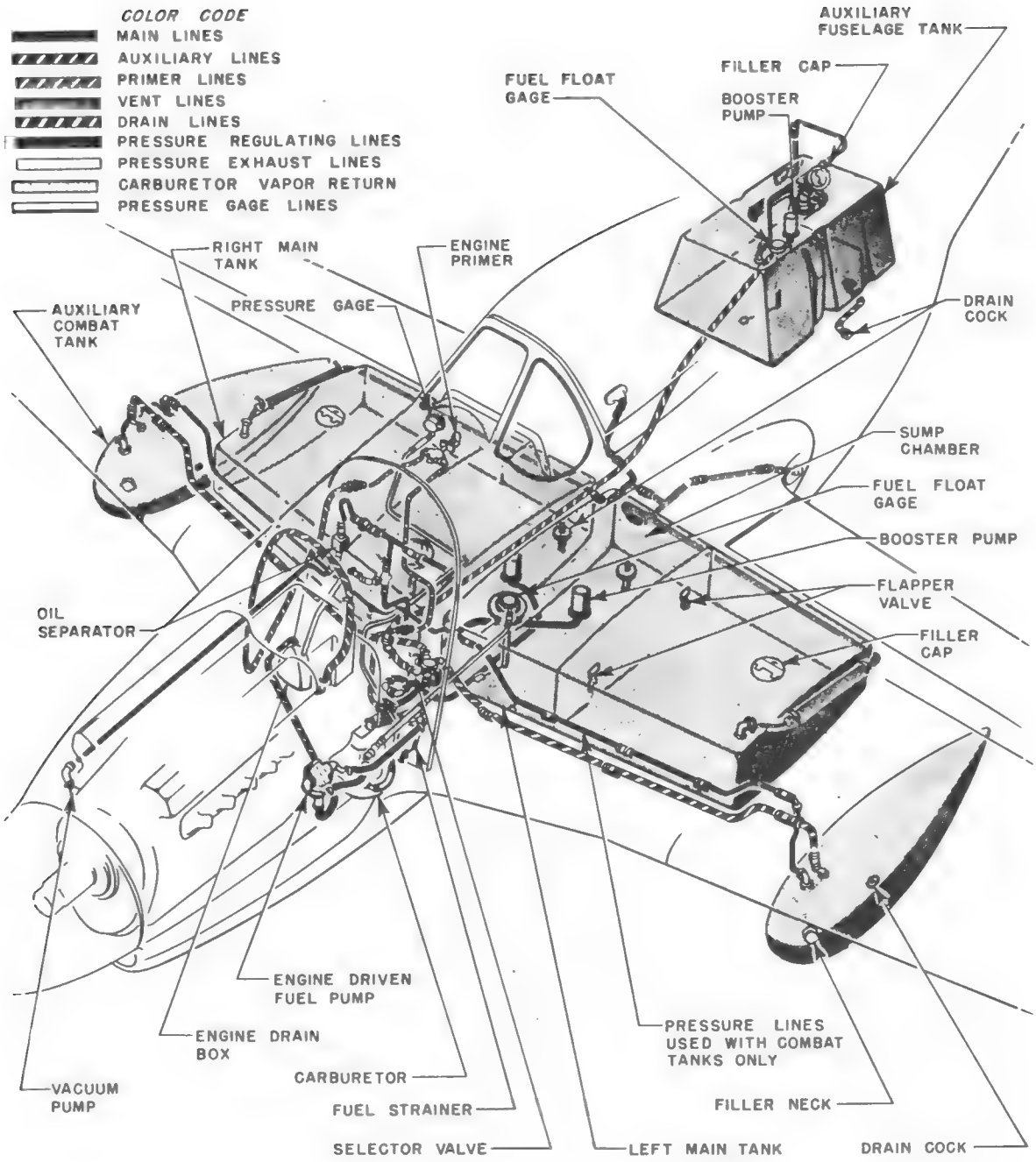


Figure 9—Fuel System

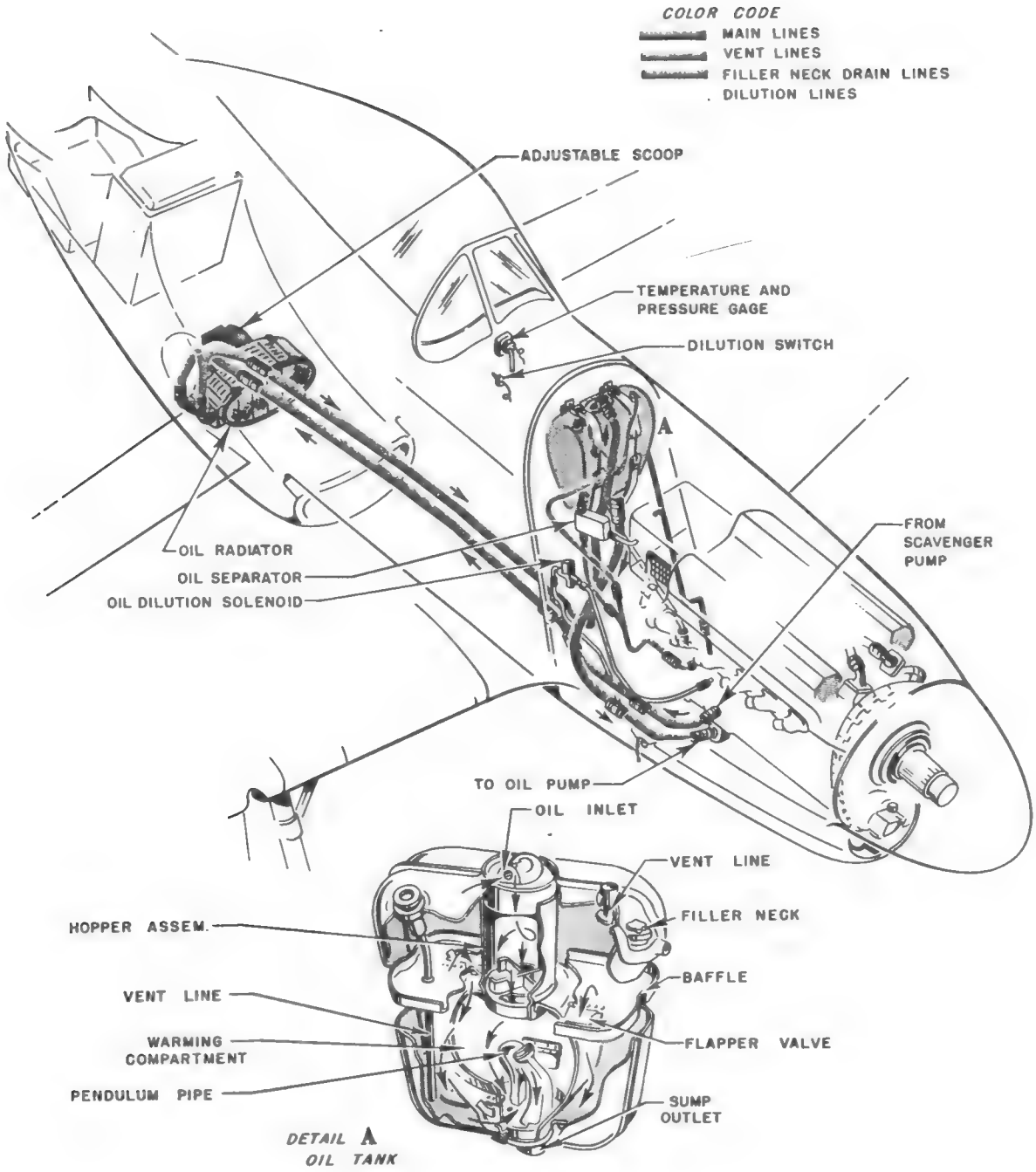


Figure 10—Oil System

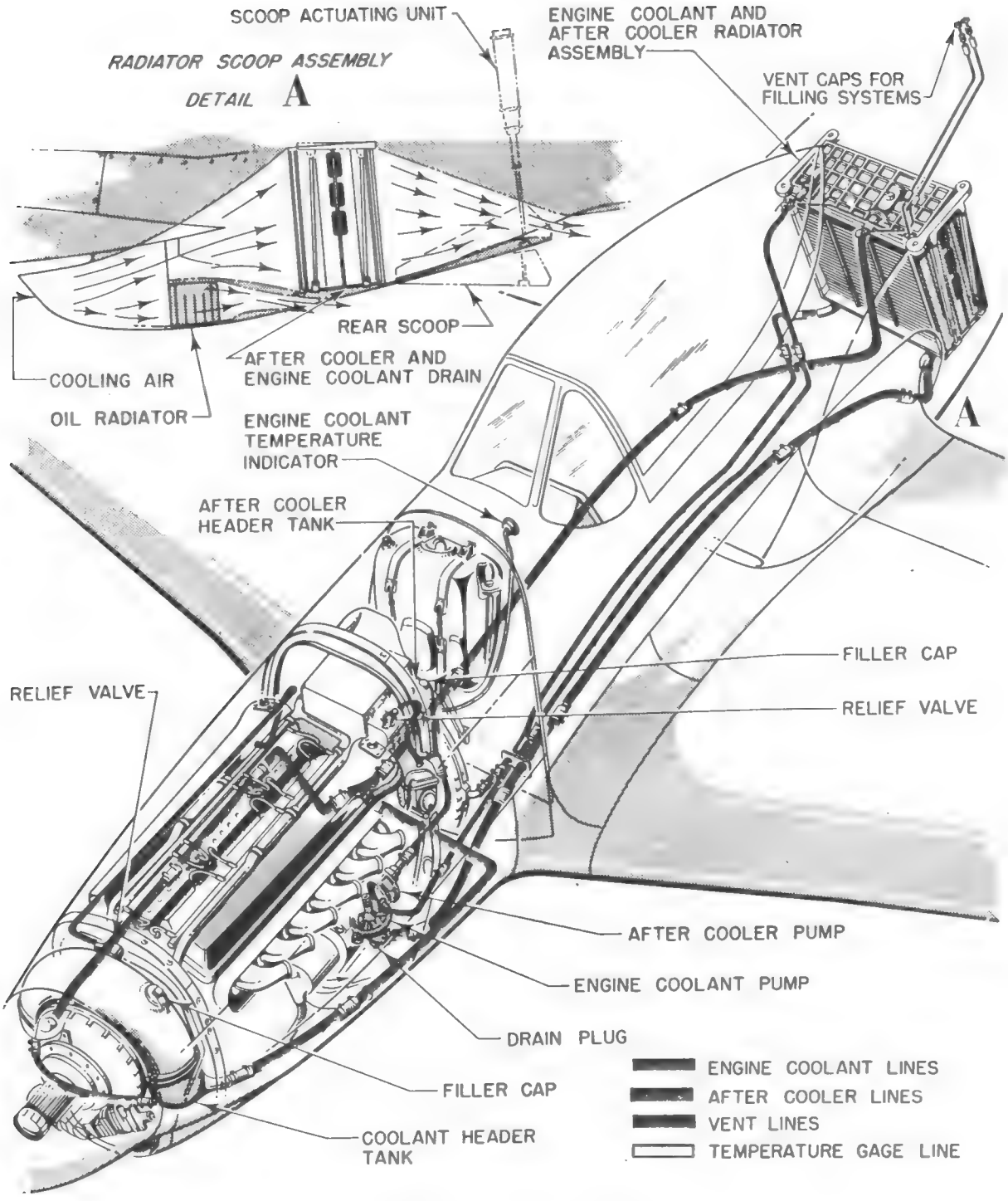


Figure 11—Cooling Systems

11. MISCELLANEOUS EQUIPMENT.

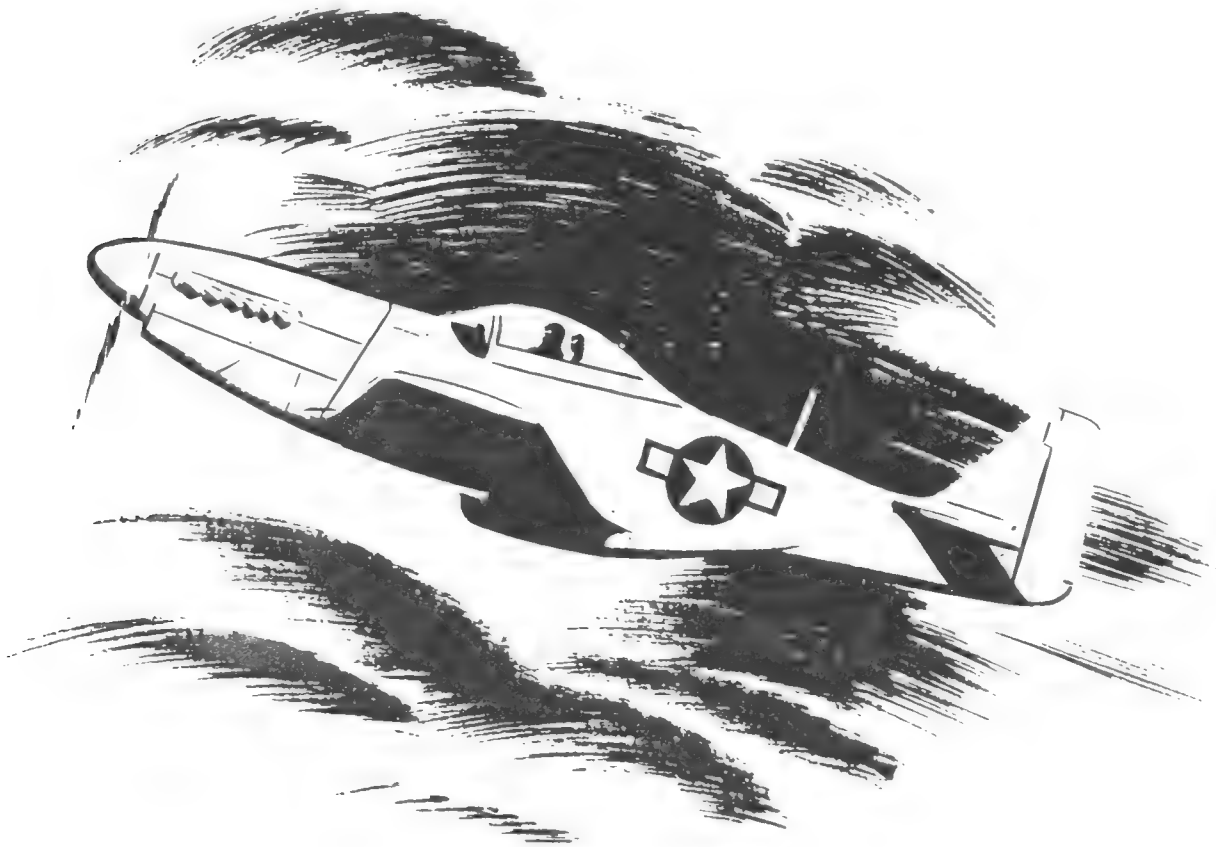
a. MEDICAL FIRST-AID KIT.—A medical first-aid kit is fastened to a holder on the fuselage at the right of the pilot's seat.

b. PILOT'S RELIEF TUBE.—The relief tube horn is stowed on a bracket on the floor to the left of the pilot's seat.

c. DROP MESSAGE BAG.—A drop message bag is contained in a holder on the map case cover.

d. FLASHLIGHT.—A small flashlight is located on the left underside of the instrument cowl.

e. ENGINE CRANK.—An engine crank and extension tube are stowed on brackets at the back of the right main landing gear well.



SECTION II

Pilot's Operating Instructions

NOTE

A pilot's check list and an engine limitations plate are provided in the cockpit for a quick check of airplane operations.

1.. FLIGHT RESTRICTIONS.

a. MANEUVERS PROHIBITED.

(1) When external fuel tanks are installed, only normal flying attitudes are permitted.

(2) Inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenger pumps to operate in an inverted position.

(3) Intentional "power-off" spins are permitted, provided such spins are started above 12,000 feet.

(4) Intentional "power-on" spins and snap rolls are prohibited.

b. AIRSPEED LIMITATIONS.

(1) The maximum permissible diving speed is 505 IAS.

(2) Observe the following wing flap setting airspeed restrictions:

(a) With wing flap setting at 10 degrees, do not exceed 400 IAS.

(b) With wing flap setting at 20 degrees, do not exceed 275 IAS.

(c) With wing flap setting at 30 degrees, do not exceed 225 IAS.

(d) With wing flap setting at 40 degrees, do not exceed 180 IAS.

(e) With wing flap setting at 50 degrees, do not exceed 165 IAS.

(3) In a sideslip, stay above 110 IAS.

(4) Do not extend landing gear above 170 IAS.

(5) With droppable 75-gallon combat fuel tanks installed, speed is limited to about 400 IAS due to incipient buffeting.

2. BEFORE ENTERING COCKPIT.

a. Make sure the airplane has been serviced and is ready for flight, particularly in regard to proper quantities of fuel, oil, coolant, hydraulic fluid, and oxygen.

Figure 12—Rudder Pedal Adjustment

b. Ascertain that the total weight of fuel, oil, ammunition and special equipment carried is suited to the mission to be performed. This is most important in the case of combat missions, as the rate of climb of the airplane may vary as much as 500 feet per minute, depending on the load carried.

c. Prior to any ground run-up exceeding 40 in. Hg manifold pressure, see that the tail of the airplane is anchored securely to a fixed object. If wheel chocks are available, use them also.

d. To gain access to cockpit, push in on spring-loaded door on left forward side of sliding canopy, and slide canopy aft.

3. ON ENTERING COCKPIT.

a. The following procedures should be carried out prior to all flights:

(1) Adjust rudder pedals for proper leg length so as to obtain full brake control while taxiing. Adjustment may be made with the foot by pressing the lever located on the inner side of each rudder pedal.

(2) Adjust the seat level to obtain full travel of the rudder pedals in the extreme positions. The adjustment lever for raising or lowering the seat is located on the right side of the seat.

(3) See that ignition switch is "OFF."

(4) Set parking brakes by pulling out the handle below the center of the instrument panel, depressing the brake pedals, releasing the pedals, and then releasing the handle.

(5) On early airplanes only, make sure the bomb release handle is in the "LOCK" position and the antisalvo guard is in place.

(6) See that the bomb and gun safety switches are "OFF."

(7) See that landing gear control handle is in the "DOWN" position.

(8) Unlock surface control lock at the base and just forward of the control stick by pulling the plunger on the left side of the lock. Check the controls for free and proper movement, watching control surfaces for correct response.

(9) Set altimeter to correct barometric pressure.

(10) Test gun sight illumination by operating rheostat control on pilot's switch panel. (Gun safety switch must be moved to "GUNS" or "GUNS AND CAMERA" for test.)

(11) Check remote reading compass for correct reading.

(12) Check landing gear warning light on instrument panel by pushing test switch adjacent to light.

(13) Close sliding canopy as follows:

(a) Push in on axle of crank on right side of cockpit to engage clutch.

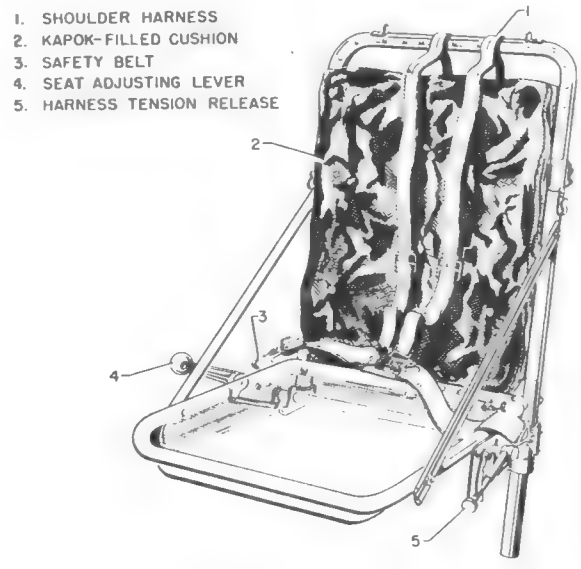


Figure 13—Pilot's Seat

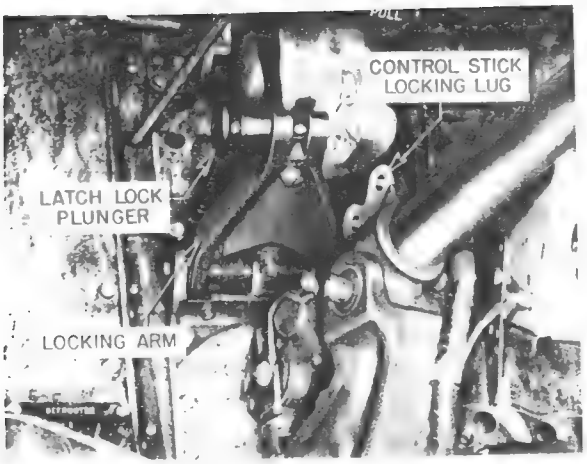


Figure 14—Surface Control Lock

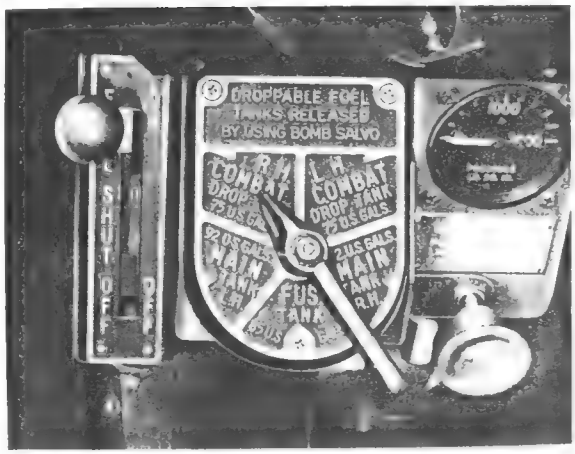


Figure 15—Fuel Selector Control

WARNING

If red indicators show through openings on each side of the forward end of the enclosure, the emergency release is unlocked and unsafe for flight.

(b) Disengage pin on crank handle from the holes on the face of the clutch housing by pulling crank knob inboard gently.

(c) Turn crank counterclockwise, holding knob inboard, to close canopy.

b. When night flying is anticipated, the following additional checks should be made:

(1) Test fluorescent instrument lights by operating rheostat controls. The control for the left light is on the radiator air control panel; the control for the right light is on the right-hand switch panel.

(2) Test position lights by moving switches on right-hand switch panel to "BRIGHT" and "DIM."

(3) Test landing light by operating switch on radiator air control panel.

(4) Test cockpit swivel lights on each side of cockpit by turning on switch located on lamp housing. The cockpit light master switch on the pilot's switch panel must be "ON" before turning on the lights.

(5) Test operation of recognition lights; the switches are on the right-hand switch panel. The keying switch is on the right longeron.

NOTE

Do not operate recognition lights longer than 10 seconds on the ground.

4. FUEL SYSTEM MANAGEMENT.

a. Take off and climb to a safe altitude with the fuel selector valve on "FUS. TANK," and the booster pump switch in "EMERGENCY." If fuselage tank is not serviced, take off and climb with fuel selector valve on "MAIN TANK L.H."

NOTE

The fuselage tank should be used for take-off and climb to a safe altitude as it is the most direct system to the engine and is on a higher plane in relation to the engine. Use of the fuselage tank fuel will also move the C.G. of the airplane forward to a more desirable position for flight.

b. When a safe altitude has been reached, when droppable tanks are installed, switch fuel selector valve to either of the droppable tank positions and use the fuel from them alternately until they are empty; then drop them.

NOTE

The combat tanks have no booster pump; a controlled pressure of 5 lbs./sq. in. is maintained within the tanks by pressure obtained from the vacuum pump.

c. Switch selector valve back to "FUS. TANK," with booster pump switch in "NORMAL," and use all but 25 gallons of the fuel to relieve tail heaviness.

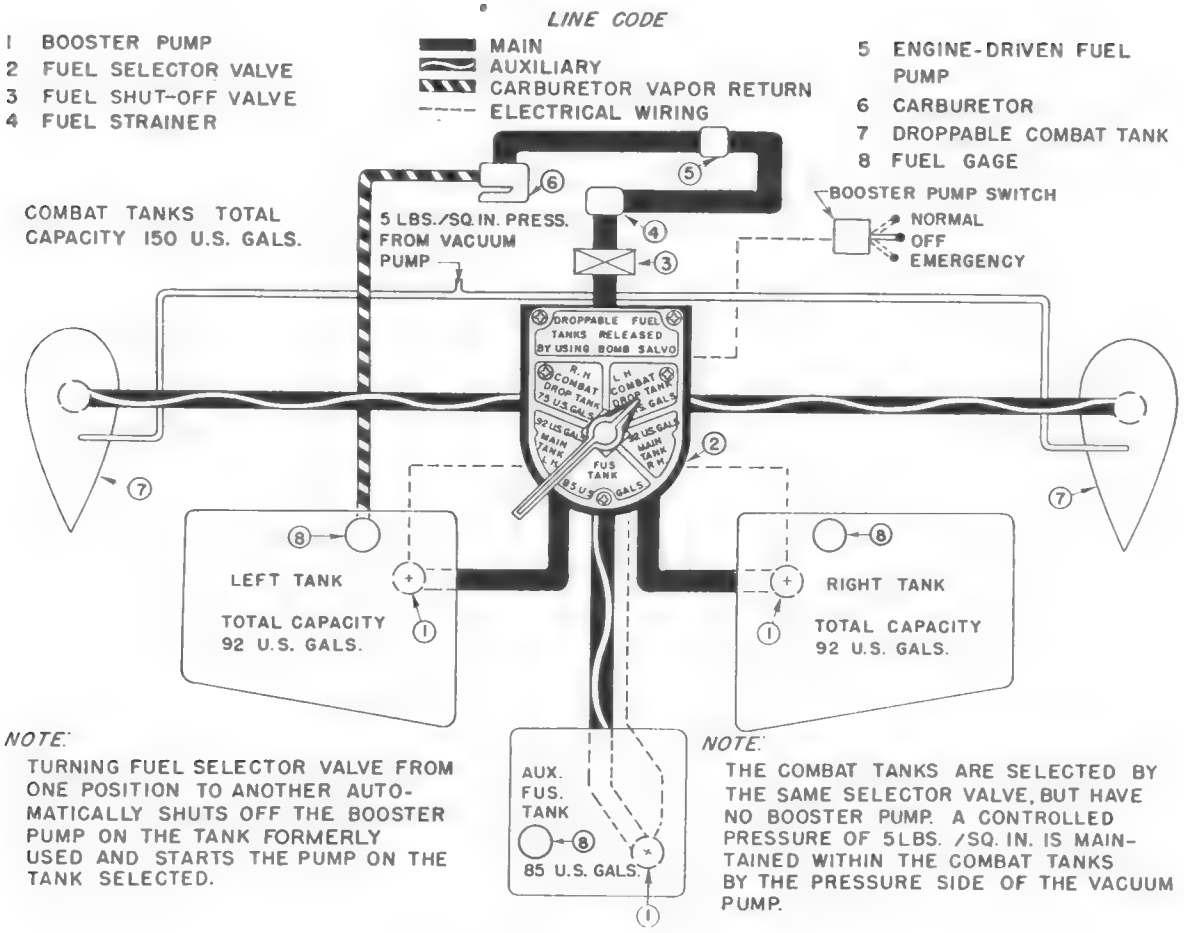


Figure 16—Fuel System Line Diagram

IMPORTANT

It is desirable to retain approximately 25 gallons of fuel in the fuselage tank in order to have the C.G. of the airplane in the optimum position for landing.

d. Switch selector valve to "MAIN TANK L.H."; alternately use fuel from the left and right main tanks to avoid wing heaviness until the wing tanks are empty.

NOTE

Turning the selector valve from one position to another automatically shuts off the booster pump on the tank formerly used and starts the pump on the tank selected.

e. When wing tanks are empty, switch selector valve back to "FUS. TANK."

5. STARTING ENGINE.

a. The sequence of operations listed below should be followed in starting the engine.

(1) See that ignition switch is "OFF."

(2) Turn generator-disconnect and battery-disconnect switches "ON." These switches are located on the right-hand switch panel.

(3) Have ground personnel turn the propeller several revolutions by hand.

(4) Open throttle one inch.

(5) Move mixture control to "IDLE CUT OFF."

(6) Move propeller control to full "INCREASE."

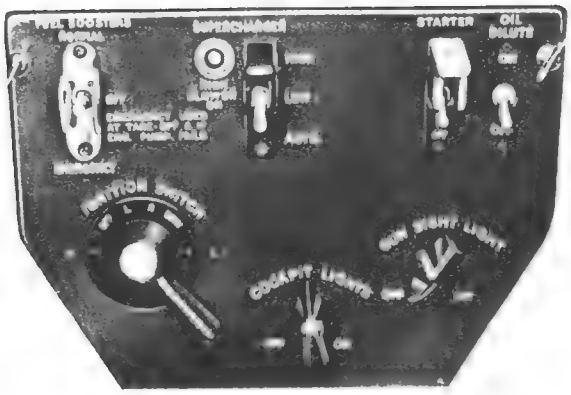


Figure 17—Pilot's Switch Panel

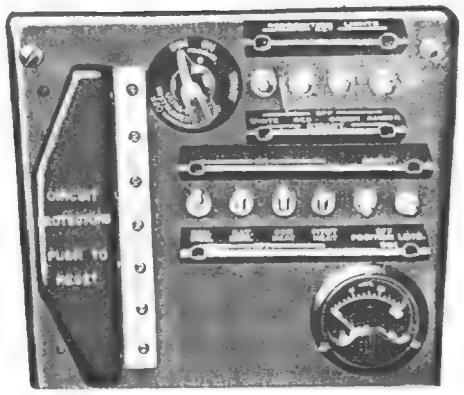


Figure 18—Right-hand Switch Panel

(7) Make certain boost control on lower left side of instrument panel is in "AUTOMATIC."

(8) See that supercharger blower switch on pilot's switch panel is in "AUTO."

(9) Turn oil and coolant radiator air control switches at left side of cockpit to "AUTOMATIC."

(10) Move carburetor air control at aft end of control pedestal to "RAM AIR" ("UNRAMMED FILTERED AIR," if required).

(11) Turn ignition switch on pilot's switch panel to "BOTH."

(12) Turn "ON" fuel shut-off control, which is adjacent to the fuel selector valve at base of pilot's switch panel, place booster pump switch in "NORMAL," and turn fuel selector valve to "FUS. TANK," or "MAIN TANK L.H." if fuselage tank is not serviced.

(13) Check fuel pressure gage for 8 to 12 pounds pressure.

(14) Prime engine 3-4 strokes when cold, one when hot.

(15) Check to see that propeller is clear.

(16) Lift guard on starter switch on pilot's switch panel and press switch to "START."

NOTE

Whenever possible, an external power supply should be used to start the engine. If external power is not available, use handcrank. Use airplane's battery in an emergency only.

Figure 19—Radiator Air Control Panel

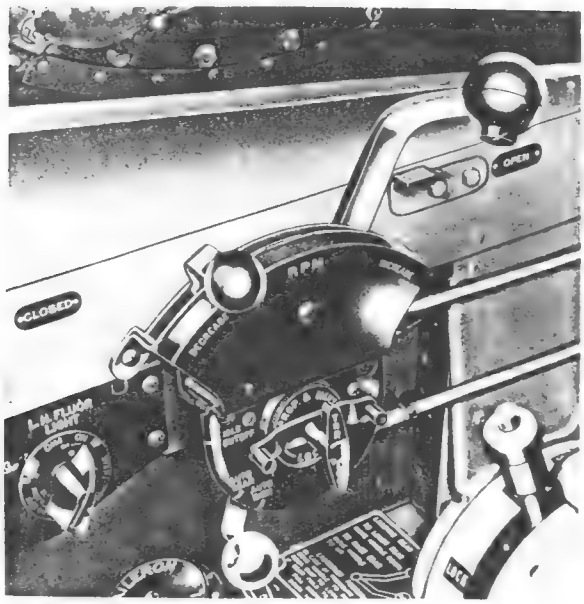


Figure 20—Engine and Propeller Controls

(17) As engine starts, move mixture control to "AUTO RICH." If engine does not start after several turns, continue priming.

WARNING

When engine is not firing, mixture control should be in "IDLE CUT OFF."

(18) Check oil pressure. If pressure is not up to 50 pounds within 30 seconds, stop engine and investigate.

6. ENGINE WARM-UP.

Warm up the engine at 1300 rpm until the oil temperature shows a definite increase and the oil pressure remains steady when the throttle is opened. The desired oil and coolant temperatures will be maintained by having the radiator air controls in "AUTOMATIC."

	DESIRED	MAXIMUM
Oil temp.	70- 80°C (158-176°F)	90°C (194°F)
Coolant temp.	100-110°C (212-230°F)	121°C (250°F)

If coolant and oil temperatures exceed limits with controls in "AUTOMATIC," shut engine off and investigate.

7. EMERGENCY TAKE-OFF.

Use oil dilution (2 minutes maximum) to obtain proper oil pressure at moderate power, and as soon as the engine will take the throttle, taxi out, and take off.

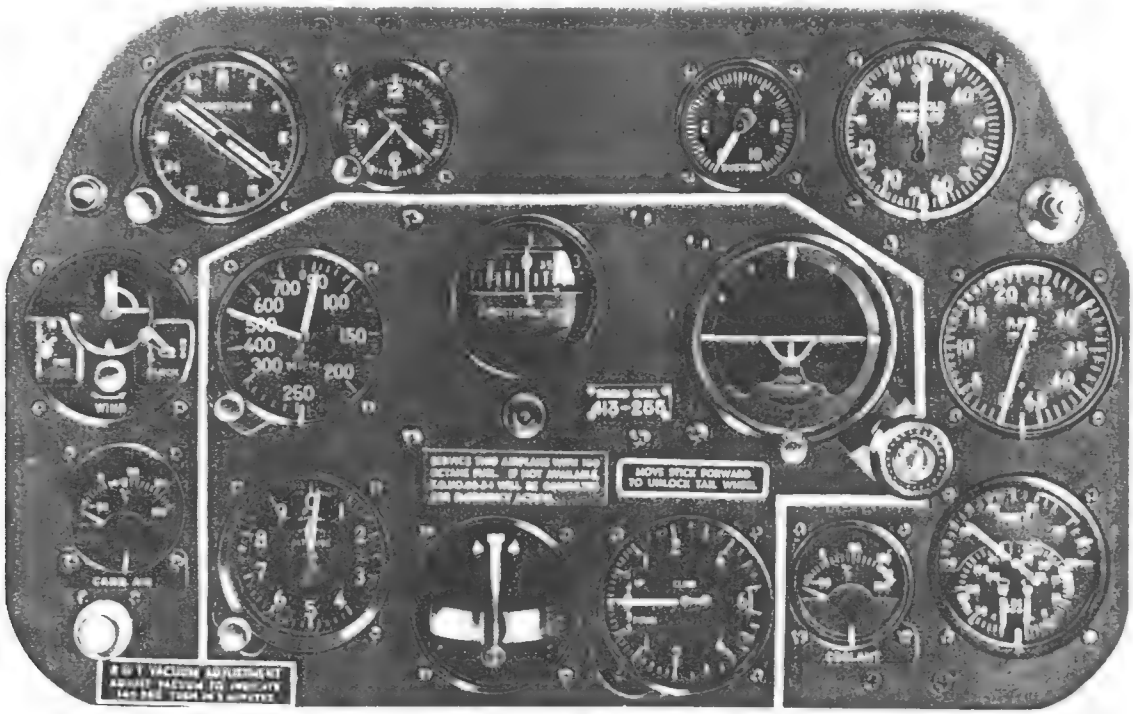


Figure 21—Instrument Panel

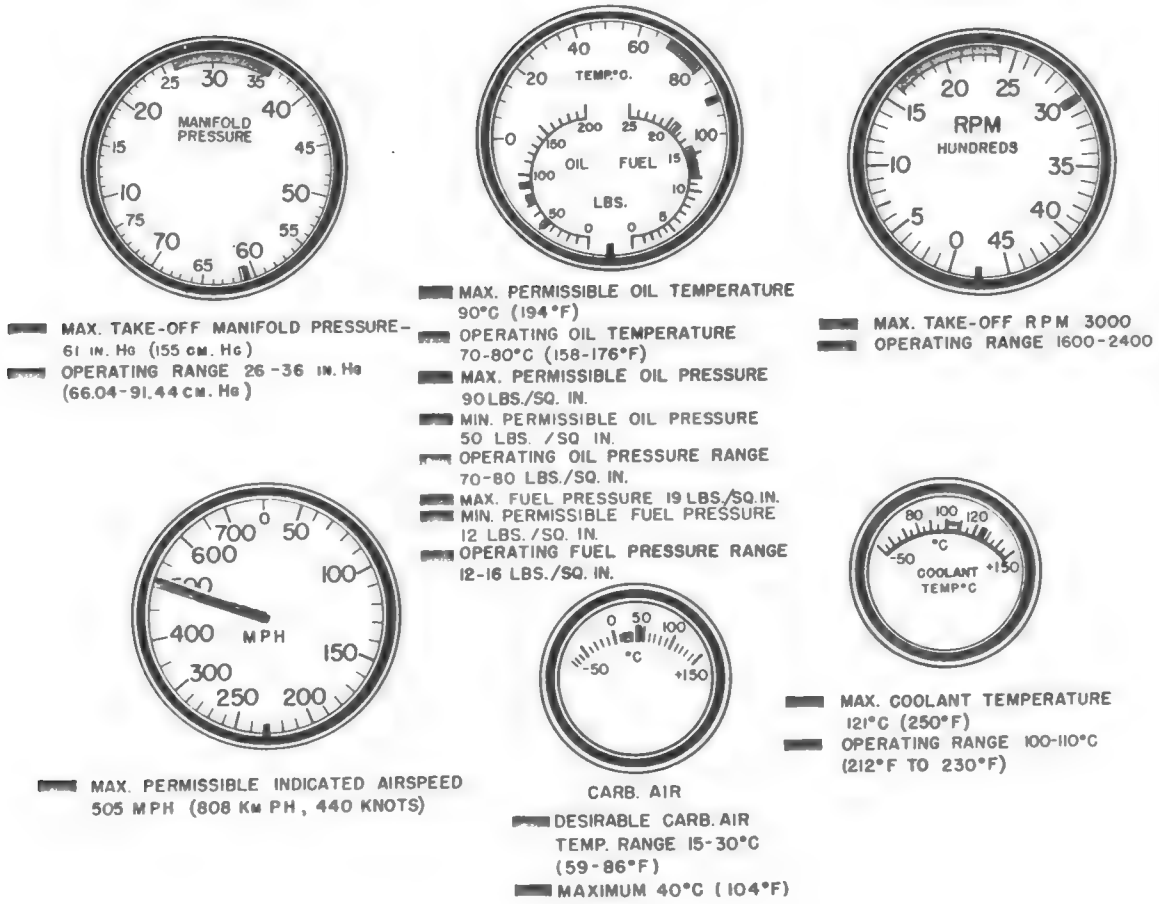


Figure 22—Instrument Limitations

NOTE

Overdilution is likely to result under these conditions because of low oil flow and a cold engine which holds back evaporation. If dilution is used, close observation of the oil pressure will be necessary during the time of dilution and take-off to determine whether or not the oil has been overdiluted, resulting in low oil pressure, and loss of oil through the engine breathers.

8. ENGINE AND ACCESSORIES OPERATION GROUND TEST.

a. After the engine has been warmed up sufficiently, proceed with these tests:

(1) Check both left and right main and fuselage fuel systems by rotating fuel selector with booster pump switch in "EMERGENCY." Check for 14-19 lbs./sq. in. pressure. If droppable tanks are installed, check fuel flow by rotating fuel selector control.

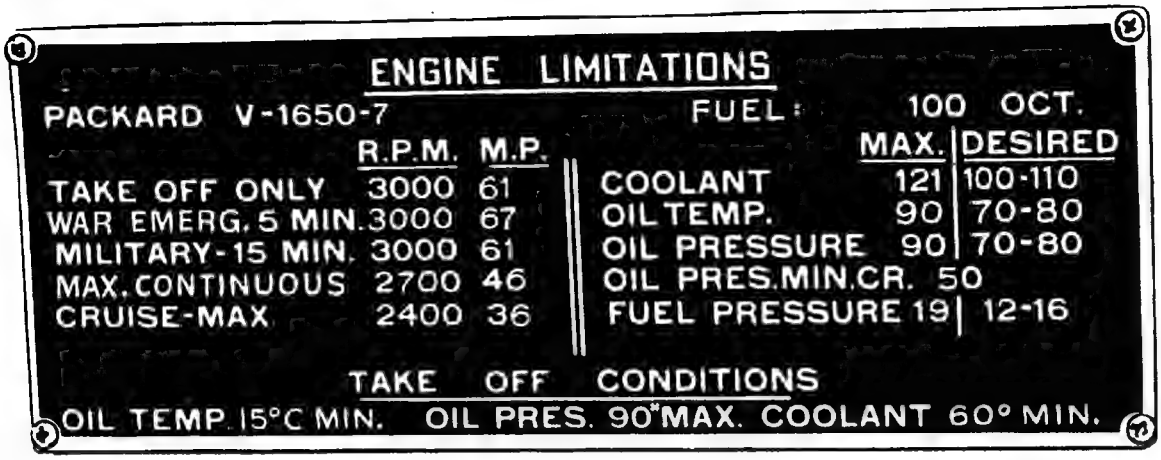
(2) Check operation of wing flaps.

(3) Check operation of radiator air exit flaps (with assistance of outside observer) using override positions of radiator air control switches. Return switches to "AUTOMATIC."

(4) Check communication equipment for proper operation.

(5) At 2000 rpm, check the following:

Suction	3.75-4.25 in. Hg
Hydraulic pressure	800-1100 lbs./sq. in.
Ammeter	100 amperes maximum



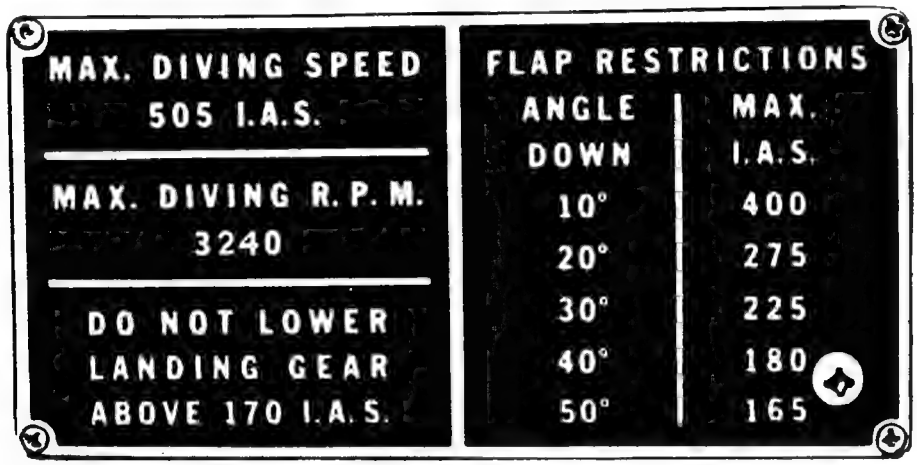


Figure 23—Engine and Airplane Limitations

(6) Check the instruments for the following limitations:

	DESIRED	MAXIMUM
Oil pressure	70-80 lbs./sq. in.	90 lbs./sq. in.
Oil temp.	70-80°C (158-176°F)	90°C (194°F)
Coolant temp.	100-110°C (212-230°F)	121°C (250°F)
Fuel pressure	12-16 lbs./sq. in.	19 lbs./sq. in.

(7) With propeller control in full "INCREASE," move throttle forward to obtain 2300 rpm. Check each magneto. A maximum loss of 100 rpm is allowable.

(8) At 2300 rpm, move propeller control back to note maximum drop of 300 rpm. Then move forward to full "INCREASE."

(9) Check supercharger operation: Set propeller control at full "INCREASE," engine speed 2300 rpm, and hold supercharger switch in "HIGH." Note rpm drop (at least 50 rpm).

(10) Notify ground personnel to release tail and remove wheel chocks.

9. TAXIING.

a. Observe the following generalities when taxiing:

(1) Raise the wing flaps.

WARNING

To prevent damage to the wing flaps, they must be up when taxiing. In addition, always taxi cautiously so as to avoid damage from objects which the tires might pick up and throw against the radiator exit flaps.

(2) Steer a zigzag course to obtain an unobstructed view.

(3) Taxi with the stick slightly aft of neutral to lock the tail wheel. In the locked position, the tail wheel may be turned 6 degrees to the right or left by the rudder pedals. For sharp turns, push the stick forward of the neutral position to allow the tail wheel full swiveling action.

(4) Use the brakes as little as possible and always taxi cautiously.

(5) Upon reaching the take-off position, stop the airplane cross-wind so that approaching airplanes may be plainly seen.

10. BEFORE TAKE-OFF.

a. Follow this sequence of operations before take-off:

(1) Set rudder trim 5° to the right, elevator trim 6° back for flaps down take-off; 3° back for flaps up take-off; aileron trim 0 degrees. With full combat and fuselage tanks and a full load of ammunition, set elevator trim ½ degree back for flaps down take-off.

(2) Check flying controls for free movement (look at control surfaces).

(3) Check fuel levels.

(4) See that fuel selector valve is set on "FUS. TANK" or "MAIN TANK L.H.," if fuselage tank is not serviced, and that booster pump switch is in "EMERGENCY" (pressure 14-19 pounds).

(5) Generator-disconnect switch "ON."

(6) Mixture control "AUTO RICH."

(7) Propeller control full "INCREASE."

(8) Supercharger blower switch "AUTO."

(9) Oil and coolant radiator air controls "AUTOMATIC."

(10) Boost control "AUTOMATIC."

(11) Carburetor air control "RAM AIR" ("UNRAMMED FILTERED AIR," if required).

(12) Sliding canopy closed and emergency release handle safetied.

11. TAKE-OFF.

a. When take-off area is clear, quickly check the following:

(1) Wing flaps 20° down ("TAKE-OFF" position).

(2) Gyro instruments "UNCAGED."

NOTE

The gyro instruments should be left "UNCAGED" at all times except during acrobatics.

(3) Oil pressure 70-90 pounds.

(4) Oil temperature 15°C (59°F) minimum, 90°C (194°F) maximum.

(5) Coolant temperature 60°C (140°F) minimum, 121°C (250°F) maximum.

(6) Open throttle to 61 in. Hg manifold pressure, and take off at 3000 rpm (5 minutes maximum).

(7) Do not attempt to lift the tail too soon, as this increases the torque action. Pushing the stick forward unlocks the tail wheel, thereby making steering difficult. The best take-off procedure is to hold the tail down until sufficient speed is attained, and then raise the tail slowly.

12. ENGINE FAILURE DURING TAKE-OFF.

a. The chances of the engine failing during take-off can be greatly reduced and prepared for by observing the following practices:

(1) Run up engine carefully and check thoroughly before take-off.

(2) Retract the landing gear as soon as the airplane is definitely airborne.

(3) Raise the flaps as soon as the airplane reaches a safe altitude.

b. If the engine fails immediately after the take-off, act quickly as follows:

(1) Depress the nose at once so that the airspeed does not drop below stalling speed.

(2) If external fuel tanks or bombs are installed, release them immediately.

(3) Release the sliding canopy by pulling the emergency release handle on top of the longeron just to the right of the instrument panel.

IMPORTANT

When releasing the canopy, bend forward and lower head slightly so as to avoid a head injury from the loose enclosure.

(4) Make sure landing gear has started to come up. There is no time to take further action, and even if it is only unlocked and on the way up, the gear will collapse on landing. Do not try to lower gear. There is less chance of personal injury if the airplane is landed with the gear up.

(5) Lower the flaps fully, if possible.

(6) Move mixture control to "IDLE CUT OFF" and turn "OFF" ignition switch.

(7) Turn fuel shut-off valve "OFF."

(8) Turn battery-disconnect switch "OFF."

(9) Land straight ahead, only changing direction sufficiently to miss obstructions.

(10) After landing, get out of the airplane as quickly as possible and remain outside.

13. CLIMB.

a. As soon as the airplane is sufficiently clear of the ground, proceed as follows:

(1) Retract the landing gear by pulling the landing gear control handle inboard and up. The handle is located on the control pedestal to the left and just forward of the seat.

(2) Raise the flaps by pulling flap control to the full up position when sufficient airspeed is attained and all obstacles are cleared. No sink is noticeable when the flaps are raised.

(3) Check the coolant and oil temperatures, and the oil pressure.

(4) As the rate-of-climb can vary widely, depending on weight being carried, external loading, and altitude, refer to Take-off, Climb, and Landing Chart in Appendix II for the rate-of-climb applicable to the particular mission to be conducted.

14. DURING FLIGHT.

a. GENERAL.

(1) As soon as desired altitude is attained, turn booster pump switch to "NORMAL."

(2) Set propeller and throttle controls to desired rpm and manifold pressure.

(3) Periodically check for these desired instrument readings:

Oil pressure 70-80 lbs. (50 lbs. min., 90 lbs. max.)
Oil temp. 70-80°C (158-176°F)
(15°C (59°F) min., 90°C (194°F) max.)
Coolant temp. 100-110°C
(60°C (140°F) min., 121°C (250°F) max.)
Fuel pressure 12-16 lbs.
Suction 3.75-4.25 in. Hg

NOTE

With the radiator air controls set in the "AUTOMATIC" position, the coolant temperatures will be approximately 100-110°C (212-230°F) and the oil temperatures will be approximately 70-80°C (158-176°F). It should be noted that with very high powers on hot days, even though the radiator air controls are in the "AUTOMATIC" position, these temperature limits may be exceeded because the exit flaps are in the full-open position, making it impossible for the automatic control to maintain the above desired temperature limits.

(4) For engine operation, see Specific Engine Flight Chart, Section III, and Flight Operation Instruction Charts, Appendix II.

b. WAR EMERGENCY RATING.

(1) GENERAL.

(a) The basis for establishing the War Emergency Rating, given on the Specific Engine Flight Chart in Section III, is to make available to the pilot in combat the absolute maximum manifold pressure at which the engine may be operated, within reasonable safety limits, for a 5-minute period under emergency conditions.

(b) The War Emergency Rating is considerably in excess of the ratings given in the engine specification under which the engine was delivered. Use of the War Emergency Rating will decrease the engine's normal service life and time between overhauls, and therefore should be held for use only when emergency conditions exist. The War Emergency Rating is not a guaranteed power rating; it is a maximum manifold pressure rating, available for emergency operation only, as established by the correct setting of the automatic manifold pressure regulator, and the correct setting of the propeller governor to allow the propeller to turn at 3000 rpm.

(c) The War Emergency Rating is to be used only when each of the following requirements is strictly complied with:

1. In combat or precombat areas as designated by the Army Air Forces, and then only when emergency conditions exist.

2. When Spec. No. AN-F-28 fuel is used.

3. The mixture control must be set in the "AUTO RICH" position.

4. The propeller control must be set in the full "INCREASE RPM" position to maintain 3000 rpm.

5. When KLG RC 5/5 or Lodge RS 5/3 spark plugs are installed.

6. The break-through seal must be installed on the emergency boost control lever to inform the crew chief that the engine has been operated at War Emergency Ratings, so that he will then make special inspections and checks. Close co-ordination between the pilot, crew chief, and engineering officer will be required to maintain an accurate record of the time the engine has been operated at War Emergency Rating conditions. When five hours of War Emergency time have been accumulated, the engine should be pulled for tear-down inspection and reconditioning.

7. During the use of War Emergency Ratings, with Spec. AN-O-5, Grade 1100p lubricating oil in the system, the following oil inlet temperature must not be exceeded: 95°C (203°F) for 5 minutes.

CAUTION

If oil dilution has been used, it is desirable that the engine be given 10 to 15 minutes operation at from 80 percent normal to military power prior to the use of War Emergency Ratings.

8. During the use of War Emergency Ratings, the cooling system should be filled with 70 percent water and 30 percent ethylene glycol to AN-E-2 specification, and the coolant outlet temperature should not be permitted to exceed 121°C (250°F).

9. The airplane must be placarded with a decal stating that War Emergency Ratings are permissible.

(2) OPERATION.—If the airplane is so placarded and it is deemed necessary to use the War Emergency Rating, proceed as follows:

(a) Place mixture control in "AUTO RICH."

(b) Move propeller control to full "INCREASE."

(c) Pull out on boost control lever from "AUTOMATIC" to "EMERGENCY."

(d) Advance throttle to full open position.

(e) Use War Emergency Rating for 5 minutes maximum.

(f) Push boost control lever in.

15. ENGINE FAILURE DURING FLIGHT.

Follow instructions in Section IV, paragraph 2.

16. FLYING CHARACTERISTICS.

a. GENERAL.—The airplane is stable at all normal loadings, but the directional trim changes at low speeds as speed and horsepower output is varied. The trim tab controls are sensitive and must be used carefully. The effect of flap and landing gear operation on the trim of the airplane in flight is as follows:

Landing gear retracted—airplane becomes tail heavy.
Landing gear extended—airplane becomes nose heavy.
Flaps lowered—airplane becomes nose heavy.
Flaps raised—airplane becomes tail heavy.

A sustained sideslip cannot be performed in this airplane; recovery should be effected above 200 feet.

b. FLIGHT CHARACTERISTICS FOR AIRPLANES WITH FUSELAGE TANK INSTALLATION.

IMPORTANT

The pilot should become accustomed to the handling qualities of the airplane with full fuselage tanks before engaging in any maneuvers. One or two hours of flying should acquaint the pilot with the airplane characteristics.

(1) FUSELAGE TANK FULL.—The stability of the airplane improves rapidly as fuel is expended from the fuselage tank. The stick forces will reverse when entering a tight turn or attempting a pull-out with the fuselage tank full. Considerable forward pressure on the stick is necessary to prevent the airplane from tightening up in a turn or pull out to a marked degree. The tendency is more severe in left turns than in turns to the right. In this condition, it is practically impossible to turn the aircraft for hands-off level flight.

(2) FUSELAGE TANK HALF FULL.—When this condition is reached, the stability is much improved. A slight tendency to tighten up is noticeable in left turns only

and it is impossible to trim for hands-off level flight. The airplane stability improves rapidly and the flying characteristics are normal as more fuel short of the half-full position is used.

17. MANEUVERS PROHIBITED.

a. Only normal flying attitudes are permitted when the airplane is carrying external fuel tanks.

b. The airplane should not be intentionally spun except under the following conditions:

(1) Intentional "power-off" spins will be permitted, provided such spins are started above 12,000 feet.

c. Intentional "power-on" spins and snap rolls are prohibited.

(1) It is impossible to do a good snap roll with the airplane and most attempts usually end up in a power spin.

(2) In the event a power spin is entered inadvertently, the throttle should be closed immediately and normal recovery methods used. The controls must be held in the recovery position until full recovery is completed. Recovery from a two to five-turn power spin may require up to six turns with a loss in altitude of as much as 9,000 feet.

18. STALLS.

The stall in this airplane is comparatively mild in that it does not whip at the stall but rolls rather slowly, and has very little tendency to drop into a spin. If the stick and rudder are released at the stall, the nose drops sharply and the airplane recovers from the stall almost instantly. When the stalling speed is reached, a wing will drop. If the backward movement on the stick continues when the wing drops, the airplane will fall into a steep spiral. In a straight "power-off" stall, some warning is given about 3 to 4 mph above the stall by slight elevator buffet. A high-speed stall is preceded by sharp buffeting at the elevators and wing root, but recovery is almost immediate when pressure on the stick is released. Recovery from any stall in this airplane is entirely normal, that is, by the release of back pressure on the stick and the application of rudder opposite the dropping wing. As the speed at which a stall occurs can vary widely, depending on the gross weight and external loads of the airplane, the stalling speed charts, figures 24 and 25 should be carefully studied before flight.

19. SPINS.

a. DIFFERENCES.—There are marked differences between a sustained left and right spin in this airplane.

(1) The left spin oscillates from 80 degrees below the horizon back to the horizon during the first turn, dampens out 50 percent during the second turn, and then becomes stable, smooth, and quiet with the nose approximately 30 to 40 degrees below the horizon.

(2) The right spin starts exactly the same as the left spin, but the oscillations continue without increasing or decreasing in magnitude.

b. RECOVERY.—Recovery procedure is the same in both a left and right spin. Upon application of opposite rudder, the nose drops slightly and the spin speeds up rapidly for 1¼ turns, after which the spin stops. Rudder force is light at first, becomes very heavy for a period of about one second at the first half turn after starting recovery, then drops to zero as the spin stops. Recovery is effected in the normal manner, that is, by applying full opposite rudder followed by movement of the stick to neutral.

NOTE

Slight rudder buffet occurs during the spin. If recovery from the dive is attempted too soon after the spin is stopped, a rather heavy elevator and rudder buffet will occur.

20. ACROBATICS.

The acrobatic qualities of this airplane are exceptional, and the lateral control is excellent at all speeds. All acrobatics except snap rolls are permitted. However, inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenger pump to operate in inverted position.

21. DIVING.

The maximum permissible diving speed is 505 IAS, during which the engine speed must not exceed 3240 rpm. The use of elevator tabs is not required for dive recovery because of the low elevator control forces. As the airplane gains speed very rapidly in a dive, it is of utmost importance to make allowance of ample altitude for a safe recovery before starting the dive. The Estimated Diving Limitations Chart, figure 26, indicates the estimated minimum safe altitudes required for a pull-out from dives of

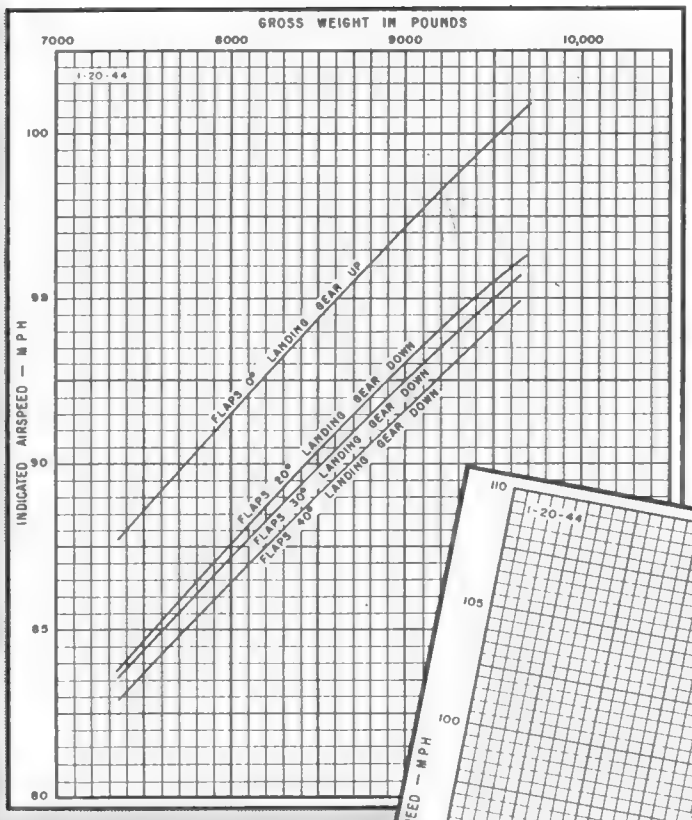


FIG. 24
STALLING SPEEDS
NO EXTERNAL LOAD

WARNING:
AIRPLANE STALLS AT APPROXIMATELY 10 MPH HIGHER IAS THAN PREVIOUS P-51 AIPLANES, DUE TO A CHANGE IN THE AIRSPEED SYSTEM.

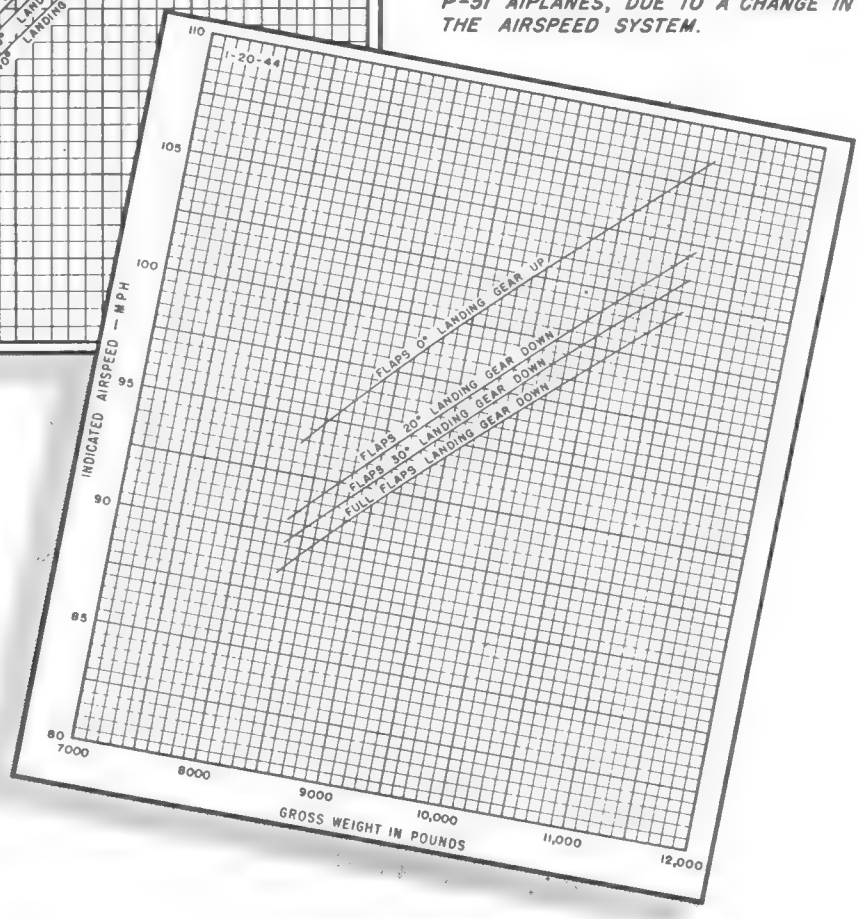


FIG. 25
STALLING SPEEDS
COMBAT TANKS

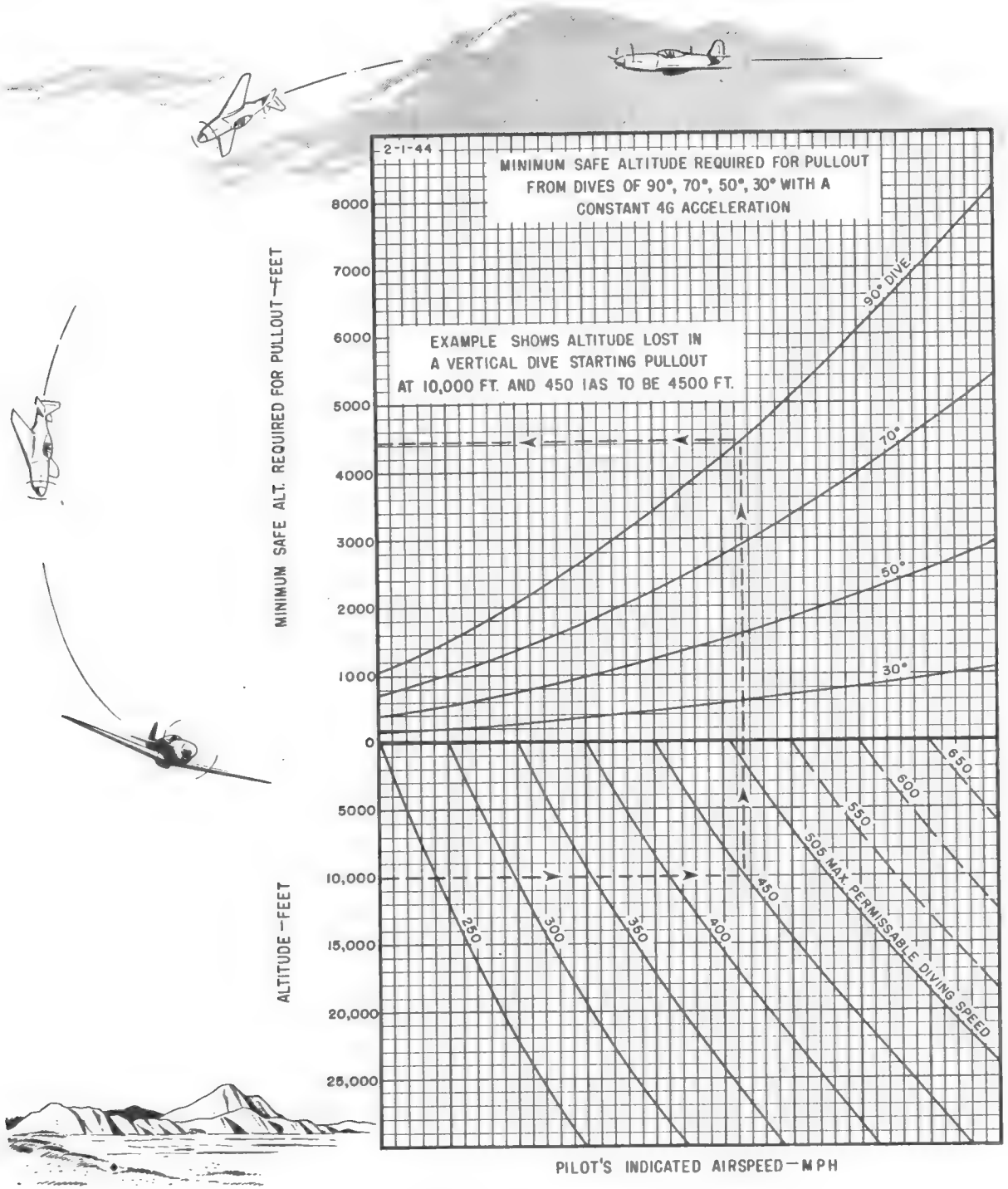


Figure 26—Estimated Diving Limitations

90°, 70°, 50°, and 30°, with a constant 4G acceleration. Pull-outs should not be attempted at greater than 4G's unless the pilot has special equipment to enable him to withstand greater accelerations without blacking out.

22. GLIDING.

Gliding may be carried out at any safe speed down to the recommended margin of about 25 percent above stalling speed. With the landing gear and flaps up, the glide is fairly flat with the nose very high. Forward visibility in this condition is poor. Lowering either the flaps or landing gear, or both, greatly steepens the gliding angle, and the rate of descent is greatly increased.

23. NIGHT FLYING.

IMPORTANT

Become accustomed to the position of the various light switches by feel, especially the switch for the landing light.

NOTE

Spare bulbs are contained in the small compartment on the right forward side of the cockpit.

a. In flying this airplane at night, the sequence outlined for daylight operation should be even more strictly observed. In addition, the pilot should familiarize himself with the location of the different lights and their control switches.

(1) INSTRUMENT LIGHTING.—Turn on the fluorescent lamps by turning the rheostat knobs (on radiator air control panel and right-hand switch panel) to "START" until the lights come on; then switch to either "ON" or "DIM" positions. Rotating the lens housing selects the visible or invisible illumination.

(2) POSITION LIGHTS.—The position light switches are on the right-hand switch panel. Two intensities of light are available: "BRIGHT" and "DIM."

(3) LANDING LIGHT.—The switch for the landing light is located on the radiator air control panel.

(4) COCKPIT LIGHTS.—A cockpit swivel light is on each side of the cockpit. Turn on light by turning switch on lamp housing. The cockpit light switch on the pilot's switch panel must be "ON" before operating the lights.

(5) RECOGNITION LIGHTS.—Set the switches, located on the right-hand switch panel, for the light or combination of lights desired. Place the switches in "STEADY" position for continuous operation and in "KEY" position for intermittent operation, by means of the keying switch on the right longeron.

24. APPROACH AND LANDING.

a. APPROACH.—When the airplane approaches the field, this sequence of operations should be followed:

(1) Mixture control "AUTO RICH."

(2) Oil and coolant radiator air controls "AUTOMATIC."

(3) Fuel selector valve to either "MAIN L.H.," "MAIN R.H.," or "FUS. TANK." Booster pump switch "NORMAL."

(4) Propeller control set for 2700 rpm.

(5) Lower the landing gear below 170 IAS. Check position of gear by the warning light on the instrument panel.

(6) If desired, the flaps may be lowered 15 degrees to give a steeper approach angle. When the airplane has been brought into the wind for landing, the flaps should be lowered fully at an altitude of at least 400 feet, provided the indicated airspeed is below 165 IAS and above 100 IAS.

b. LANDING.

(1) GENERAL.—Having turned into the field and lowered the flaps, maintain a correct gliding speed. Adjust the elevator trim tab to assist in landing. Having stopped after landing, raise the flaps before taxiing.

(2) CROSS-WIND LANDING. — As this airplane has a landing gear of wide tread and a locked tail wheel, cross-wind landings may be negotiated safely. Keep one wing down, into the wind, to counteract drift.

(3) TAKE-OFF IF LANDING IS NOT COMPLETED.—In the event of an unsuccessful attempt to land, open the throttle and then push the propeller control forward to full "INCREASE." Raise the landing gear immediately; then, when the airspeed has reached 100 IAS, raise the flaps.

25. STOPPING ENGINE.

a. To stop engine, proceed as follows:

(1) Turn booster pump switch "OFF."

(2) If a cold weather start is anticipated, hold oil dilution switch, on pilot's switch panel, "ON" (2 minutes maximum).

(3) Run engine to 1500 rpm, set mixture control to "IDLE CUT OFF" and move throttle fully open. Leave mixture control in "IDLE CUT OFF" as a precaution against accidental starting.

(4) Turn ignition switch to "OFF" after the engine ceases firing.

(5) Turn "OFF" fuel shut-off valve.

26. BEFORE LEAVING COCKPIT.

a. After engine stops, proceed as follows:

(1) Turn "OFF" all switches.

(2) Set parking brakes.

WARNING

If brakes are hot as a result of frequent applications, wait until they have cooled before applying parking brakes. Otherwise, the brake discs will fuse to each other.

(3) Lock the control surfaces.

(4) Place the carburetor air control in "UNRAMMED FILTERED AIR" position.

(5) Pull out on sliding canopy crank handle, place pin between holes on face of clutch housing, and push on knob of handle. This will disengage crank axle from clutch and allow canopy to be moved manually.

(6) Close canopy after leaving cockpit.

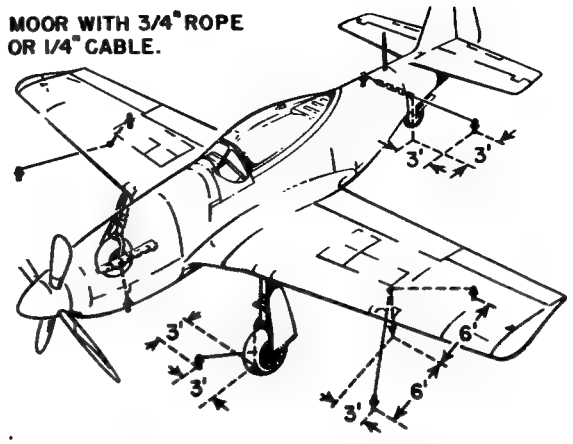


Figure 27—Mooring Airplane

27. TYING DOWN.

a. Head the airplane into the wind.

b. Set the parking brakes.

c. Lock the surface control lock, using the lower locking notch on the control stick in order to lock the tail wheel.

d. Moor the airplane with ¾-inch rope or ¼-inch cable. Secure the wing with two ropes at each of the mooring rings in the wing, one tied 6 feet forward and 3 feet outboard, and one tied 6 feet aft and 3 feet outboard of each mooring ring. Secure each main landing gear towing lug to the ground with a rope tied 3 feet forward and 3 feet inboard of the respective towing lug. Moor the tail section of the fuselage to the ground with one rope strung through the lift tube and tied on each side of the airplane, 2 feet aft and 3 feet outboard of the lift tube.

e. Install engine and cockpit covers.

SECTION III

Flight Operating Data

1. SPECIFIC ENGINE FLIGHT CHART.

a. Operating limitations and characteristics of the V-1650-7 engine are summarized for ready reference on the Specific Engine Flight Chart *(figure 28)*. A similar chart *(figure 29)*, applicable to the V-1650-3 engine, is provided for use on airplanes which have had V-1650-3 engines installed in service. The pilot should be thoroughly familiar with this information.

b. Engine power ratings shown on the chart are defined as follows:

(1) TAKE-OFF.—Maximum recommended for take-off under the specified time limit of five minutes.

(2) WAR EMERGENCY.—Maximum allowed for emergency operation during combat for a period not exceeding 5 minutes.

(3) MILITARY.—Maximum recommended for operation for periods not exceeding 15 minutes.

(4) MAXIMUM CONTINUOUS.—Maximum recommended for operation with rich mixture in climb and level flight.

(5) MAXIMUM CRUISE.—Maximum recommended for operation with lean mixture.

(6) MINIMUM SPECIFIC CONSUMPTION.—The power at which greatest range can be obtained under average loading conditions.

2. AIRSPEED CORRECTION CHART.

INDICATED AIRSPEED—MPH	CALIBRATED INDICATED AIRSPEED—MPH	ALTIMETER ERROR (FEET) ADD TO INSTRUMENT READING S.L.	10,000	20,000
180	181.5	20	25	35
210	212	25	35	45
240	242	30	45	60
270	272	35	50	70
300	302	45	60	85
330	332	50	70	100
360	362.5	60	85	115
390	393	70	100	140

SPEC. AN-H-8
DEC. 18, 1942
FORM ASC-512

AIRPLANE MODELS: P-51D

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS: PACKARD V-1650-7

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	12-16	70-80	70-80	158-176	100-110	212-230		
MAXIMUM	19	90	90	194	121	250		
MINIMUM	12	50	15	59	60	140		
IDLING	9	15						

MAX. PERMISSIBLE DIVING RPM: 3240

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	11 U.S.QT/HR ..... IMP.PT/HR
MAX. CRUISE	4 U.S.QT/HR ..... IMP.PT/HR
MIN. SPECIFIC	3 U.S.QT/HR ..... IMP.PT/HR

OIL GRADE: (S) 1100 (W) 1100

SUPERCHARGER TYPE: TWO SPEED, TWO STAGE

FUEL GRADE: SPEC. AN-F-28 GRADE 130 OCTANE 100

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.		MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	61	1490		S.L.	LOW		A.R.	161				5
WAR EMERGENCY	3000	67	1720 1505		6,200 19,300	LOW HIGH		A.R. A.R.	194 187				5
MILITARY	3000	61	1590 1370		8,500 21,400	LOW HIGH		A.R. A.R.	178 170				15
MAXIMUM CONTINUOUS	2700	46	1180 1065		11,300 23,400	LOW HIGH		A.R. A.R.	109 106				CONT.
MAXIMUM CRUISE	2400	36	820 760		14,000 23,700	LOW HIGH		A.L. A.L.	66 64				CONT.
MINIMUM SPECIFIC CONSUMPTION													

REMARKS: *ADDITIONAL INFORMATION WILL BE INCORPORATED IN THIS CHART WHEN AVAILABLE.*

Figure 28—Specific Engine Flight Chart—V-1650-7

SPEC. AN-H-8
DEC. 18, 1942
FORM ASC-512

AIRPLANE MODELS P-51D

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS PACKARD V-1650-3

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	12-16	70-80	70-80	158-176	100-110	212-230		
MAXIMUM	19	90	90	194	121	250		
MINIMUM	12	50	15	59	60	140		
IDLING	9	15						

MAX. PERMISSIBLE DIVING RPM: 3240

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	.11. U.S.QT/HR. IMP.PT/HR
MAX. CRUISE	.4. U.S.QT/HR. IMP.PT/HR
MIN. SPECIFIC	.3. U.S.QT/HR. IMP.PT/HR

OIL GRADE: (S) 1100 (W) 1100

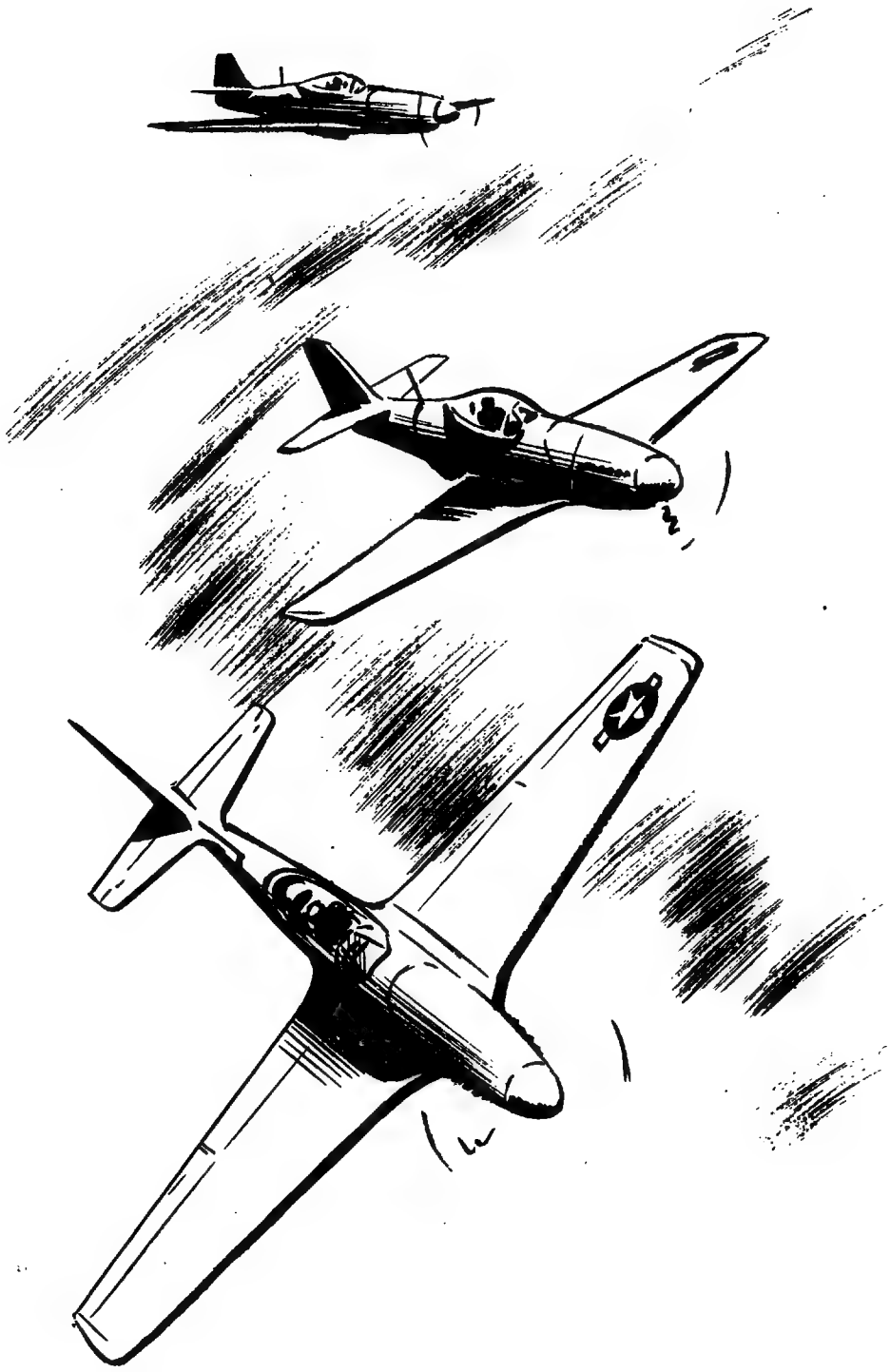
SUPERCHARGER TYPE: TWO SPEED, TWO STAGE

FUEL GRADE: SPEC. AN-F-28 GRADE 130 OCTANE 100

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.	FUEL FLOW (GAL/HR/ENG.)	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	61	1400	S.L.	S.L.	LOW		AR	150				5
WAR EMERGENCY	3000	67	1595	17,000	11,700	LOW		AR	166				5
			1295	28,800	23,200	HIGH		AR	160				
MILITARY	3000	61	1450	19,800	13,700	LOW		AR	158				15
			1190	31,200	25,600	HIGH		AR	144				
MAXIMUM CONTINUOUS	2700	46	1120	20,500	17,500	LOW		AR	111				CONT.
			940	34,400	29,500	HIGH		AR	106				
MAXIMUM CRUISE	2400	36	800	21,500	18,500	LOW		AL	74				CONT.
	2400	36	700	32,300	30,500	HIGH		AL	70				
MINIMUM SPECIFIC CONSUMPTION	1600	27	370	S.L.		LOW		AL	35				CONT.
	1600	30	440	5,000		LOW		AL	39				
	1600	31	480	10,000		LOW		AL	42				
	1800	F.T.	510	15,000		LOW		AL	45				
	2000	F.T.	560	20,000		LOW		AL	50				

REMARKS: *DATA FOR MINIMUM SPECIFIC CONSUMPTION ARE FOR AVERAGE MAXIMUM RANGE CONDITIONS*

Figure 29—Specific Engine Flight Chart—V-1650-3



SECTION IV

Emergency Operating Instructions

1. GENERAL.

All emergency instructions, except those included in Section II, have been assembled in this Section to facilitate quick reference. The pilot should thoroughly acquaint himself with these instructions before his first flight in this airplane.

2. ENGINE FAILURE DURING FLIGHT.

a. If the engine fails during flight, the airplane may be abandoned, ditched, or brought in for a dead-stick landing, as the case requires. For a landing with the engine dead, follow these instructions:

(1) Depress the nose at once so that airspeed does not drop below stalling speed.

(2) If external fuel tanks or bombs are installed, release them immediately *(see paragraph 6)*.

(3) Release the sliding canopy by pulling emergency release handle on right longeron.

WARNING

Bend forward and lower head slightly when pulling release handle so as to avoid injury from the loosened canopy. If the canopy does not fly off, move it back with handcrank.

(4) Do not lower the landing gear. There is less chance of personal injury if the airplane is landed with the gear up.

(5) Lower the flaps fully, if possible.

(6) Move mixture control to "IDLE CUT OFF" and turn ignition switch "OFF."

(7) Turn "OFF" fuel shut-off valve and battery-disconnect switch.

(8) Land into the wind, only changing direction sufficiently to miss obstructions.

(9) After landing, get out of the airplane as quickly as possible and remain outside.

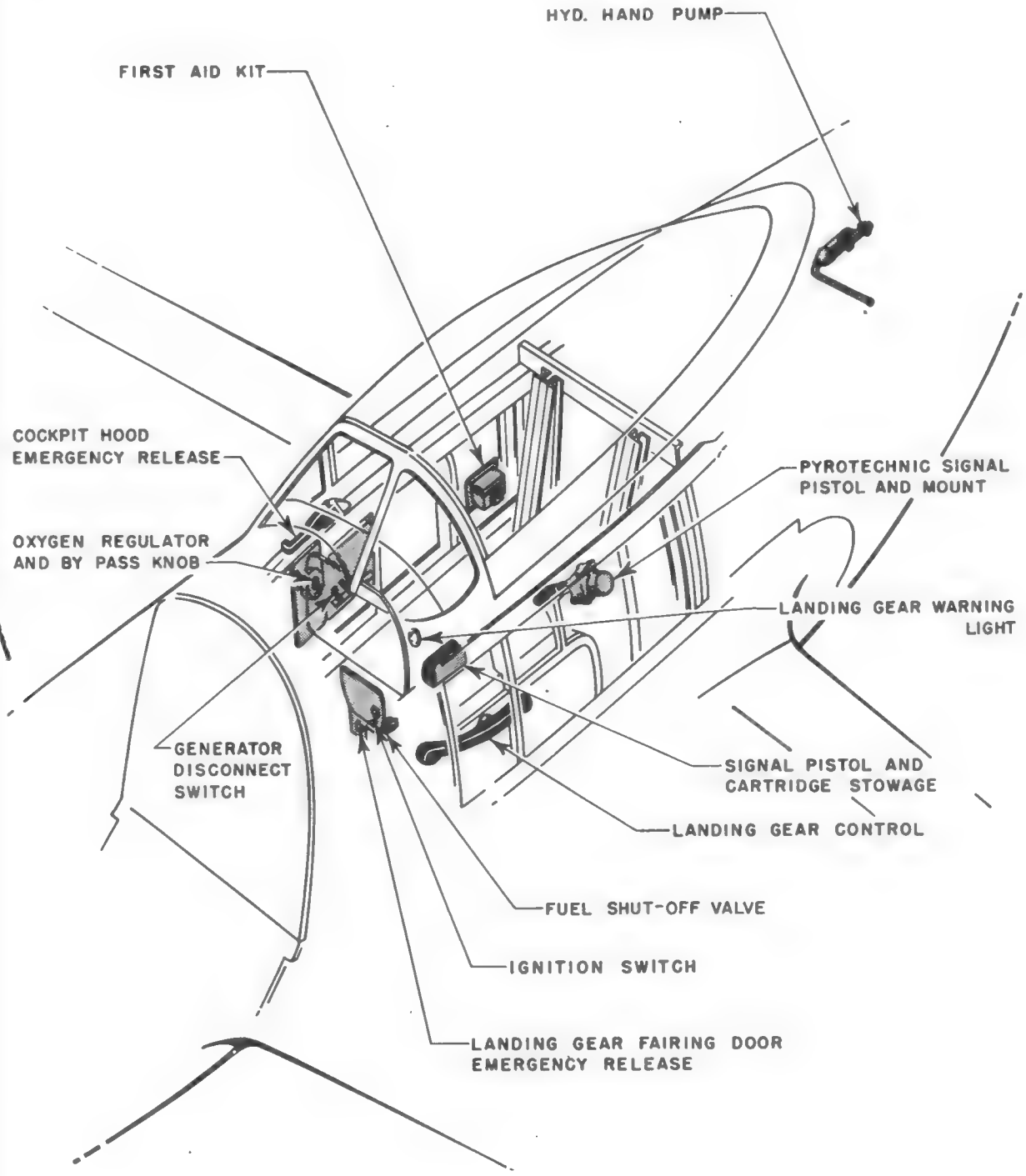


Figure 30—Emergency Equipment

3. EMERGENCY EXIT DURING FLIGHT.

a. In the event that an emergency exit must be made during flight, the following proceduces are recommended:

(1) Release sliding canopy and unfasten safety belt and shoulder harness. Roll airplane over on its back and drop out.

(2) Release sliding canopy and unfasten safety belt and shoulder harness. Climb out of cockpit, lower self onto wing, and roll off.

IMPORTANT

When pulling emergency release handle, bend forward and lower head slightly to avoid head injury when canopy releases.

4. DITCHING.

a. The airplane should be ditched only as a last resort. If, on an overwater flight, trouble arises and the pilot is quite certain that he will not be able to reach land, he should leave the airplane while in flight. However, if it is not possible to maintain sufficient altitude for a successful parachute drop, ditching is the only remaining procedure. The instructions for ditching are as follows:

(1) If bombs or droppable tanks are installed, release them immediately.

(2) Release sliding canopy. *(See IMPORTANT note in paragraph* 3.*)*

(3) Be sure the shoulder harness and safety belt are fastened securely, as there is a violent deceleration of the airplane upon final impact.

(4) Land into the wind with landing gear up. As soon as the airplane comes to rest, get out *immediately.*

DANGER

The pilot must get out quickly upon landing. After the final impact, the airplane will sink very rapidly, only remaining above the surface of the water for a period of 1½ to 2 seconds.

5. LANDING GEAR EMERGENCY LOWERING.

In the event of hydraulic system failure, the landing gear may be lowered by placing the landing gear control handle in the down position and yawing the airplane sideways. If the landing gear warning light does not go out when the throttle is retarded, pull the fairing door emergency knob, located just forward of the control stick, and then yaw the airplane sideways to force the gear into the locked position. If the tail wheel does not lock, increase the airplane's speed to increase the air load on the partially extended wheel, or dive the airplane a short distance and pull out with enough acceleration to down the tail wheel.

6. EMERGENCY BOMB OR DROPPABLE FUEL TANK RELEASE.

The bombs or droppable fuel tanks are released as follows:

a. EARLY AIRPLANES.—Hinge antisalvo guard upward and move bomb release handle to "SALVO."

b. LATE AIRPLANES.—Pull out on both emergency bomb release handles at left side of instrument panel.

7. EMERGENCY USE OF OXYGEN.

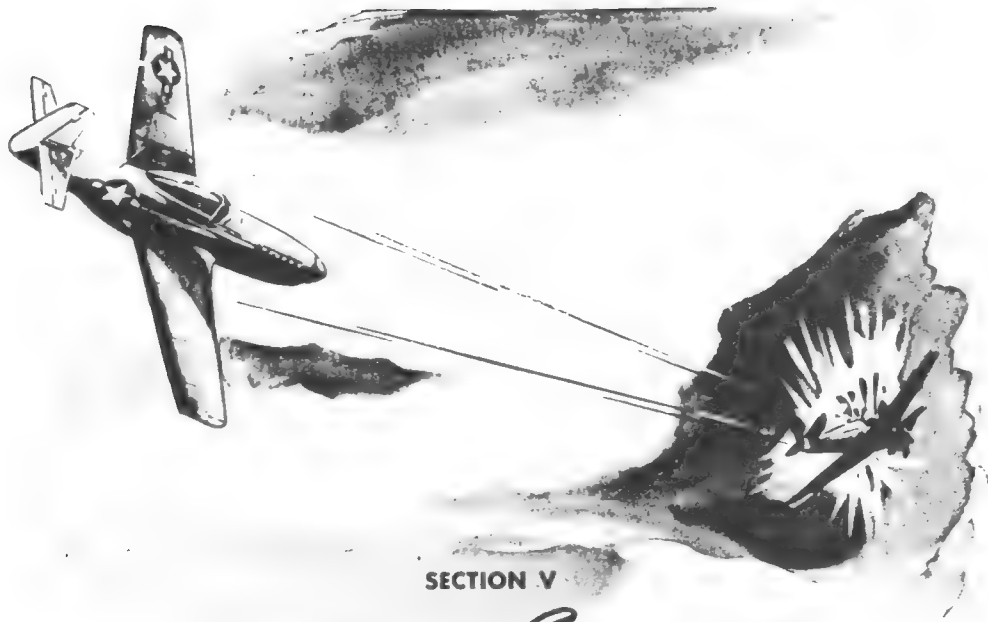
If for any reason there is a lack of oxygen or if no oxygen flow is indicated by the flow indicator, immediately turn "ON" the red emergency knob on the regulator.

8. USE OF MISCELLANEOUS EMERGENCY EQUIPMENT.

a. RADIO DEMOLITION SWITCH.—This switch, on the right side of the cockpit, controls a charge for demolishing the identification radio in an emergency. Press both buttons simultaneously to set off the charge.

b. FIRST-AID KIT.—The contents of the first-aid kit are to be used only in an emergency when medical aid is not available. Use contents of kit in accordance with the directions contained therein.

c. LIFE PRESERVER.—The back cushion on the pilot's seat is filled with kapok and may be used as a life preserver.



SECTION V

Operational Equipment

NOTE

The following instructions apply only to operational equipment not used in the actual flying of the airplane. For flight operating instructions, see Section II.

1. GUNNERY EQUIPMENT.

a. DESCRIPTION.—Either of two gun installations may be used: a maximum load of three fixed .50-caliber guns in each wing or an alternate installation of two guns in each wing. The maximum load includes 500 rounds of ammunition for each inboard gun and 270 rounds for each center and outboard gun. When the alternate installation is used, the center guns are removed, and 500 rounds of ammunition are provided for each outboard gun. An optical gun sight and an auxiliary ring sight are mounted on the instrument cowl; a bead sight is forward of the windshield. A Type N-4 gun sight aiming point camera equipped with an overrun control is mounted in the leading edge of the left wing.

b. OPERATION.

(1) On missions requiring gun heat, turn "ON" gun heater switch immediately after starting engine. Turn switch "OFF" when firing guns.

(2) On combat missions, turn gun and camera safety switch to "GUNS AND CAMERA" as soon as the airplane is safely off the ground. Doing this eliminates the possibility of the pilot forgetting to turn the switch on during the excitement of combat.

(3) To sight guns, turn gun sight rheostat, on right side of pilot's switch panel, toward "ON." Turning the rheostat in a clockwise direction increases the light intensity of the image. The gun sight will not operate until the gun and camera safety switch has been turned on.

NOTE

If the optical gun sight fails to function, install the ring sight by slipping the ring sight stem over the stud provided and rotating the ring sight to the left into the stem clip.

(4) Fire guns by squeezing trigger switch on control stick grip. To operate camera only, turn gun safety switch to "CAMERA" and squeeze trigger switch.

NOTE

When the gun and camera safety switch is on, the heaters in the camera will function automatically at low temperatures. Therefore, make certain the safety switch is "OFF" whenever the guns and camera will not be required.

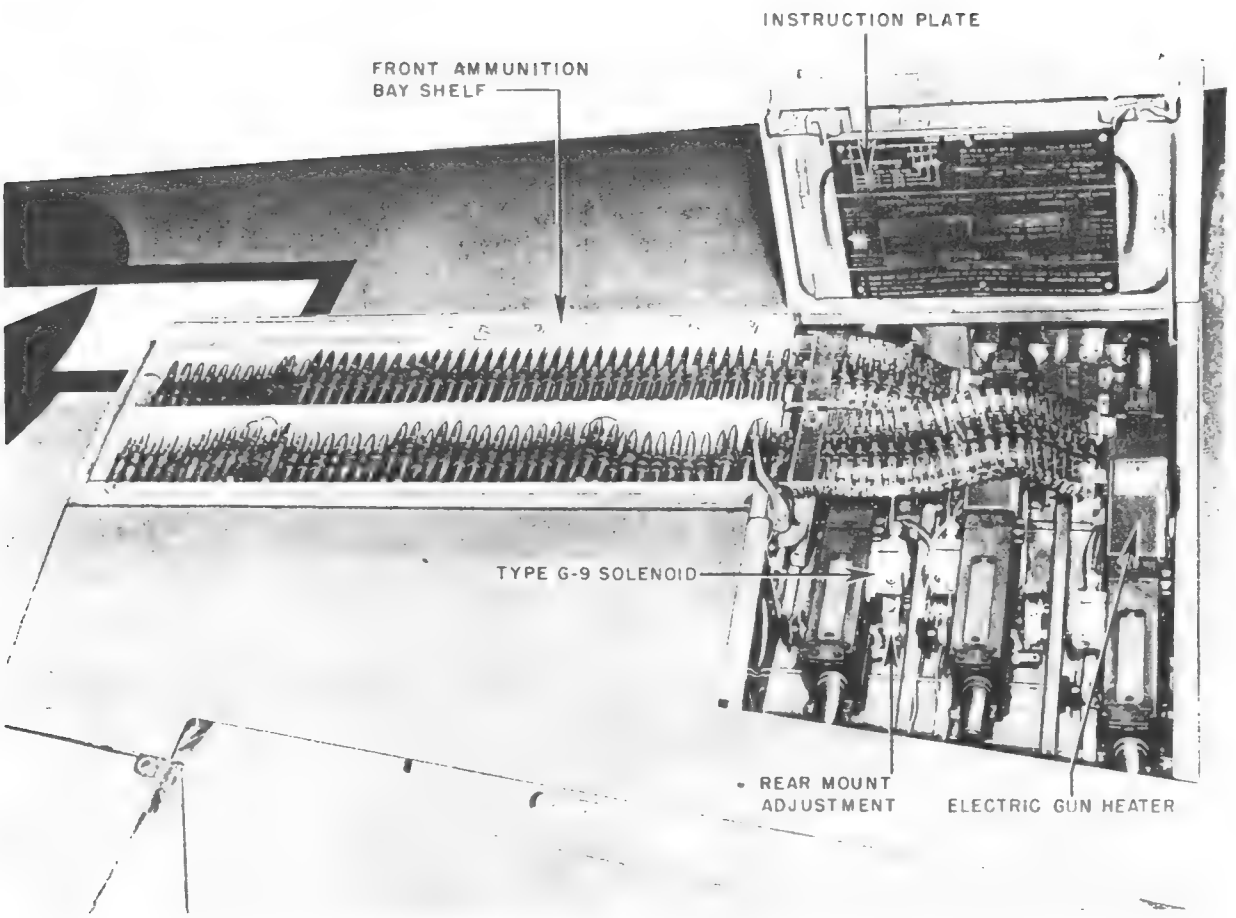


Figure 31—Wing Gun Installation

(5) Before landing, make sure that the gun and camera safety switch and gun heater switch are "OFF."

2. BOMBING EQUIPMENT.

a. DESCRIPTION.—An external, removable bomb rack may be installed under each wing. Each rack will hold one 100, 250, or 500-pound bomb. Chemical tanks or combat fuel tanks may be carried on the bomb racks when bombs are not installed. The tanks are released either by normal or salvo operation of the bomb control system. On early airplanes, a bomb salvo handle, on the left side of the cockpit, salvoes the bombs simultaneously. On late airplanes, two bomb salvo handles provide a selective mechanical release of bombs or fuel tanks. The bomb system electrical controls consist of a bomb release switch on top of the control stick, and three bomb arming switches and a bomb release selector switch on the armament control panel. The gun sight is adjustable for use in low altitude bombing.

b. OPERATION.

(1) GENERAL.—The electrical release of bombs is the normal release. The "SALVO" release is used only if the electrical release fails. The two "NOSE ARM" switches arm the nose fuse of the bombs on the left and right racks. The "TAIL ARM" switch arms the bomb tail fuse on both racks. The bomb release selector switch has the following positions: "BOTH," "SAFE," and "SELECTIVE." With the

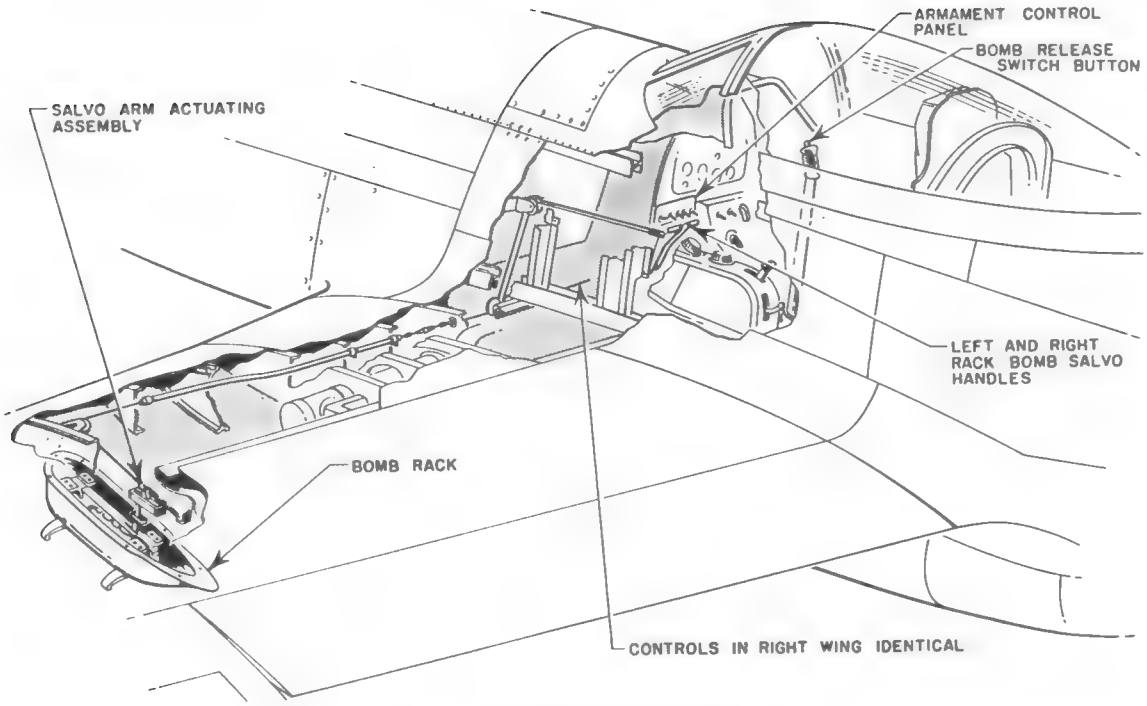


Figure 32—Bomb Rack Control System

selector switch on "BOTH," the bombs will be released simultaneously when the release switch is pressed. When the selector switch is on "SELECTIVE" and the bomb release switch is pressed, the left bomb will be released; when the bomb release switch is pressed again, the right bomb will be released. The bomb release circuit is inoperative when the selector switch is in the "SAFE" position.

NOTE

Bombs may be released when the airplane is in any attitude of flight from a 30-degree climb to a vertical dive.

CAUTION

To prevent bombs from falling into the propeller, do not release bombs when sideslipping more than 5 degrees in a vertical dive.

(2) INOPERATIVE POSITION OF CONTROLS. —When not in use, the controls shall be positioned as follows:

(a) Bomb release selector switch on "SAFE."

(b) Nose and tail arming switches "OFF."

(c) On early airplanes, bomb salvo handle with antisalvo guard down.

(3) SELECTIVE RELEASE (ELECTRICAL). — To release bombs selectively, proceed as follows:

(a) Place arming switches in desired position.

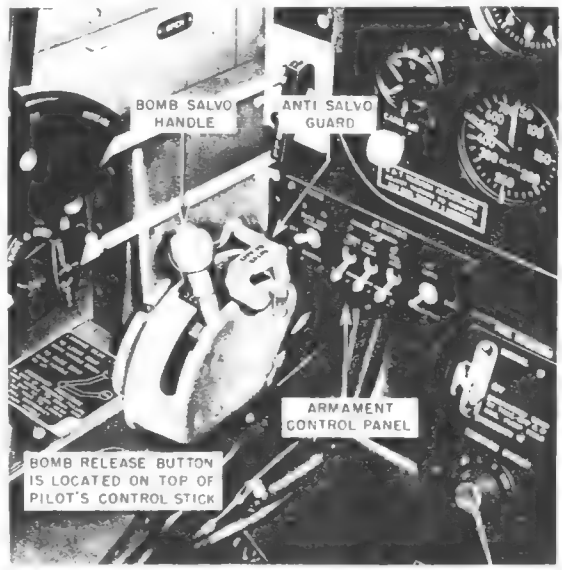


Figure 33—Bomb Controls—Early Airplanes

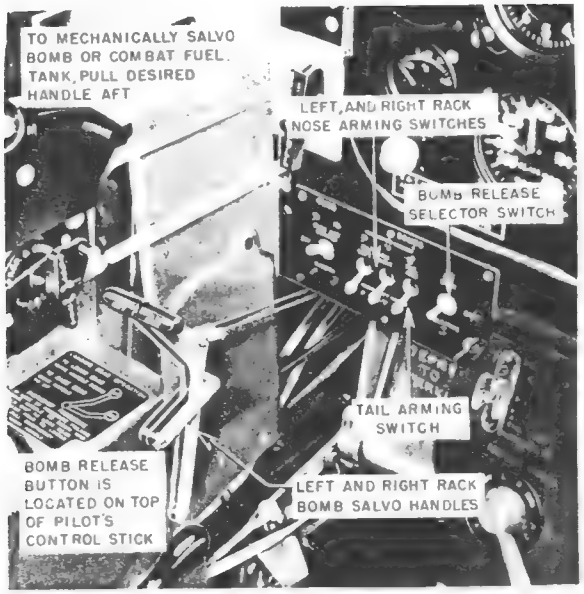


Figure 34—Bomb Controls—Late Airplanes

(b) Place bomb release selector switch on "SELECTIVE."

(c) Press bomb release switch button *momentarily* to release bomb on left rack.

(d) Press bomb release switch button again to release bomb on right bomb rack.

(e) Bomb arming switches "OFF," bomb release selector switch to "SAFE."

(4) SALVO RELEASE (ELECTRICAL).—To release both bombs simultaneously, proceed as follows:

(a) Place bomb arming switches in desired position.

(b) Place bomb release selector switch on "BOTH."

(c) Press bomb release switch; both bombs will release.

(d) Bomb arming switches "OFF," bomb release selector switch to "SAFE."

NOTE

For emergency bomb release instructions, see Section IV, paragraph 6.

3. COMMUNICATION EQUIPMENT.

a. GENERAL.—Radio equipment consists of a command set and an identification set. The command radio may be either SCR-522 or SCR-274-N. Identification equipment may be either SCR-695 or SCR-515. Additional communication equipment includes a signal pistol, a signal lamp, and recognition lights.

b. COMMAND SET SCR-522.

(1) DESCRIPTION.—This set is a push-button type of transmitter-receiver, operating on the 100 to 156 mc band *(see figures 36 and 37)*. The control box is just aft of the right-hand switch panel in the cockpit. A transmit-receive, remote control button is on the throttle lever. Lamps adjacent to the control buttons indicate which band is being used. A remote contactor, on the left side of the instrument panel, switches the transmitter from any of the four voice-modulated bands to the tone-modulated "D" band for 14 seconds of every minute. The pointer on the face of the contactor indicates when the switch's action will take place. The clock switch on the contactor should never be touched in flight; it is set on the ground by the service crew. A separate receiver, located on the floor at the pilot's right, is installed with this equipment for use in the reception of beacon signals, weather broadcasts, and airport communication.

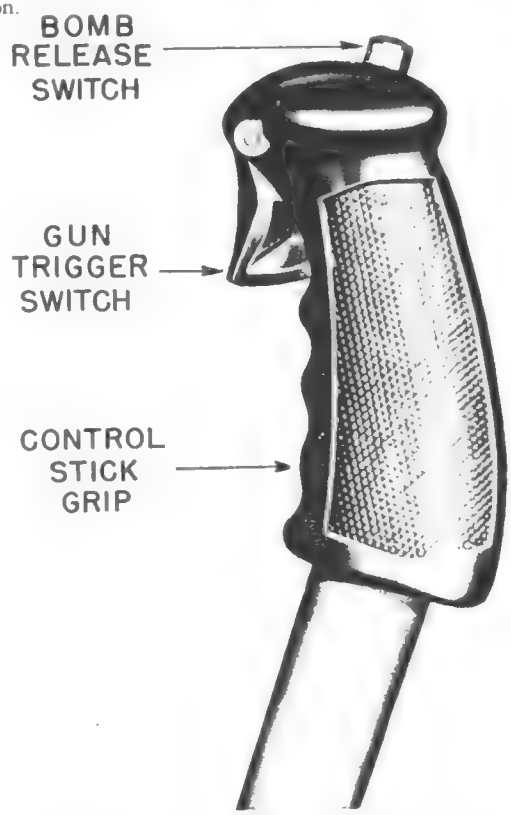
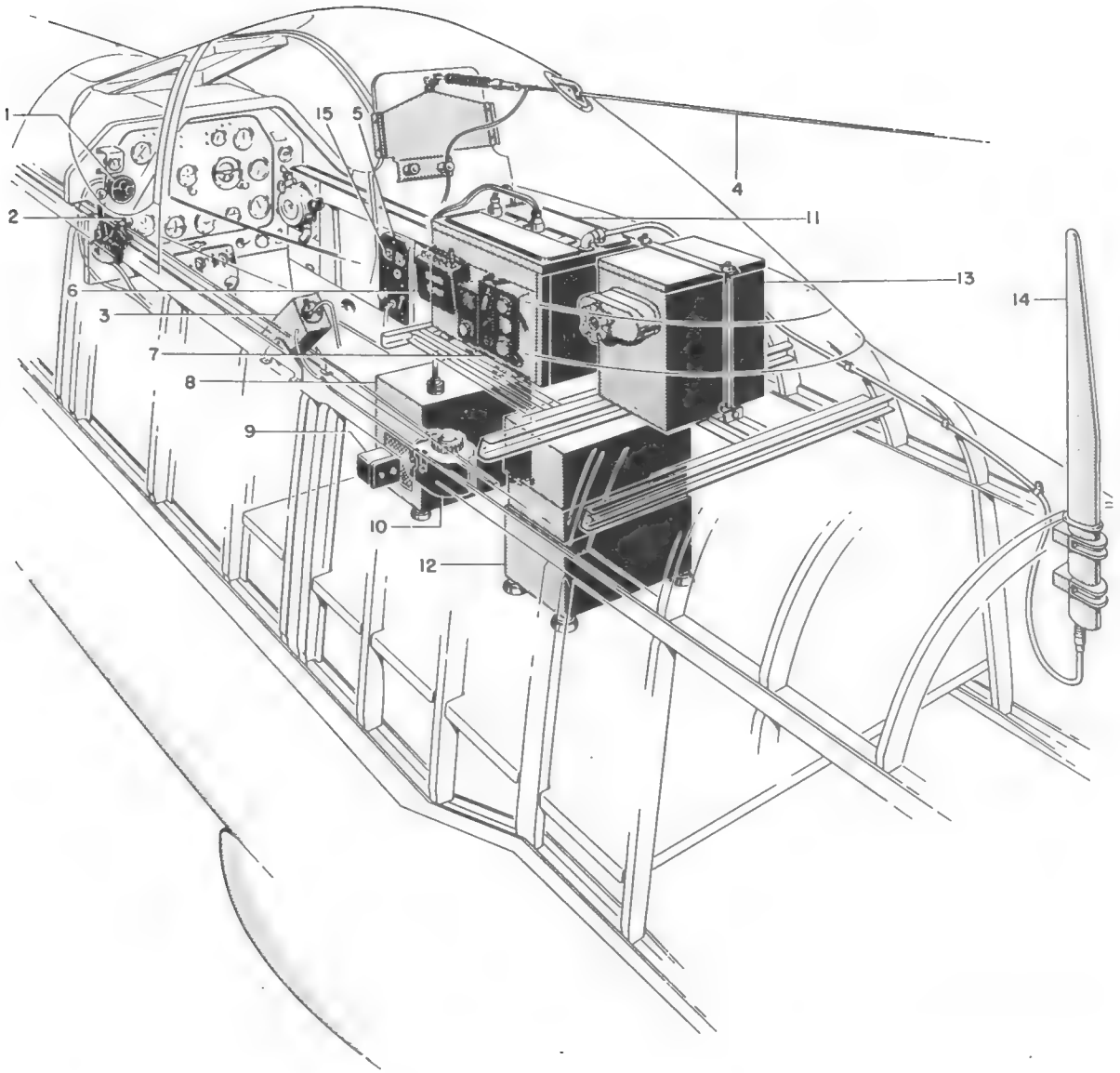
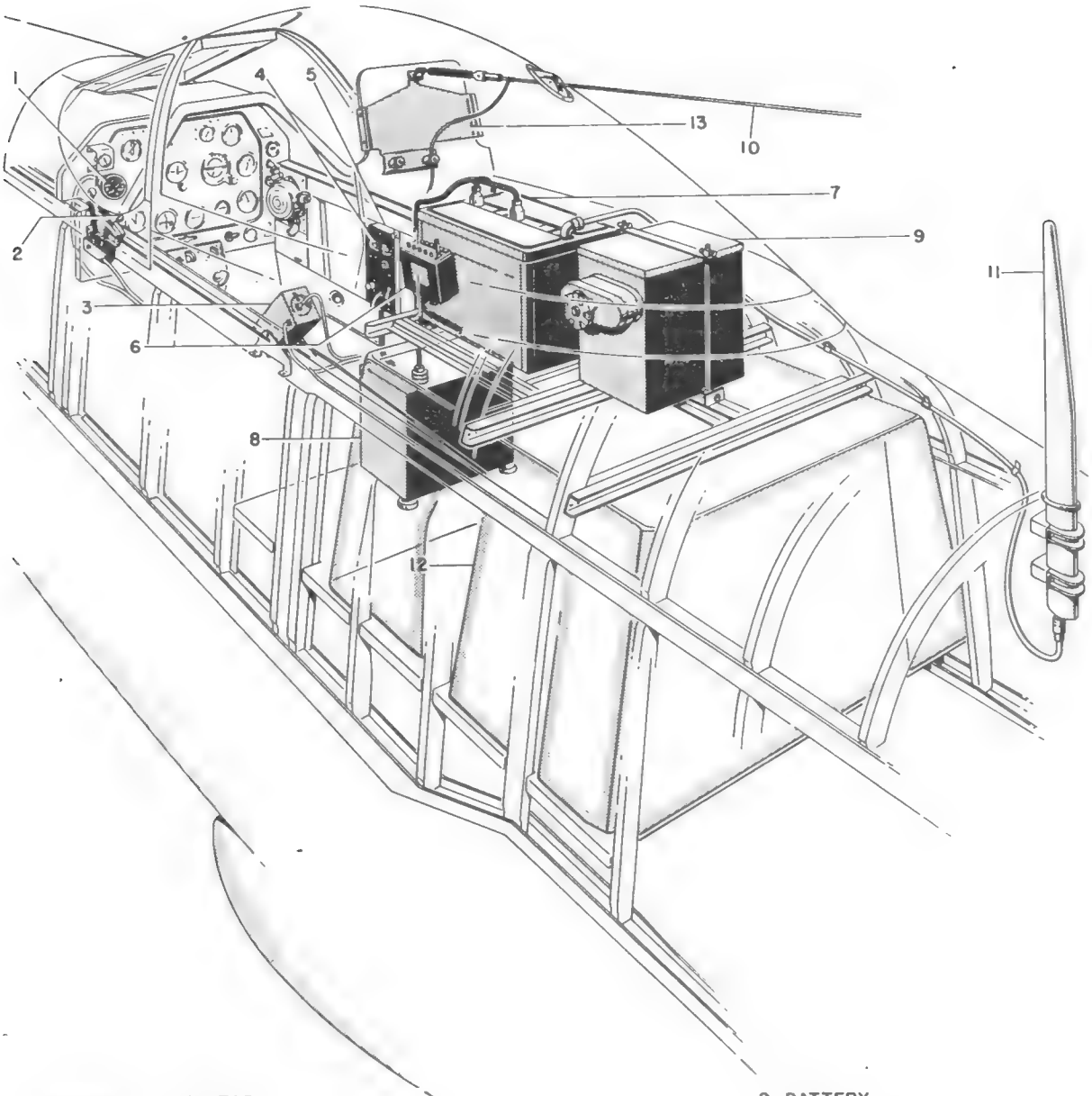


Figure 35—Gun and Bomb Control Switches



1. REMOTE CONTACTOR
2. THROTTLE SWITCH
3. DETROLA RECEIVER SCR-438
4. DETROLA 8 SCR-274-N ANTENNA
5. 106-71154 PANEL ASSEMBLY
6. CONTROL BOX SCR-522
7. CONTROL BOX SCR-695
8. POWER SUPPLY SCR-522
9. INDICATOR LAMPS SCR-695
10. INERTIA SWITCH SCR-695
11. TRANSMITTER RECEIVER SCR-522
12. RADIO SCR-695
13. BATTERY
14. ANTENNA SCR-522
15. SCR-695 DETONATOR BUTTONS

Figure 36—SCR-522 and SCR-695 Radio Equipment



1. REMOTE CONTACTOR
2. THROTTLE SWITCH
3. DETROLA RECEIVER
4. SCR-695 DETONATOR BUTTONS
5. 106-71154 PANEL ASSEMBLY
6. CONTROL BOX SCR-522
7. TRANSMITTER RECEIVER SCR-522
8. POWER SUPPLY SCR-522
9. BATTERY
10. DETROLA ANTENNA
11. ANTENNA SCR-522
12. FUSELAGE FUEL TANK
13. ANTENNA SUPPORT ASSEMBLY

Figure 37—SCR-522 Radio Equipment
(On Airplanes With 85 Gallon Fuselage Tank)

(2) OPERATION.

(a) TRANSMISSION.

1. Push button "A," "B," "C," or "D," depending upon the band to be used.

2. Allow set approximately one minute to warm up and, during this time, check contactor operation with switch in "OUT" and "IN" positions.

3. Transmit by pushing toggle switch at aft end of control box to "T" (transmit) position. To send an uninterrupted message, place contactor switch in "OUT" position.

NOTE

The lever just forward of the transmit-receive toggle switch controls the momentary or permanent action of the switch. A similar lever at the forward end of the control box regulates the brightness of the indicator lamps.

4. Move transmit-receive toggle switch to "REM" (remote control) if the remote control button on the throttle lever is to be used. Push button to transmit.

5. To turn set off, press button marked "OFF."

(b) RECEPTION.

1. Turn toggle switch at aft end of box to "R" (receive), or to "REM" if remote control is desired.

2. Press button "A," "B," "C," or "D," depending on which band is desired. Allow set approximately one minute to warm up. Reception of a signal will indicate whether the receiver is operating properly.

3. To turn set off, press button marked "OFF."

NOTE

The auxiliary receiver used with this set is turned on and off by the hexagonal control knob. The round knob is the frequency control.

c. COMMAND SET SCR-274-N.

(1) DESCRIPTION.

(a) GENERAL.—This set consists of two transmitters and three receivers with independent controls for each group, an antenna switching relay, and the necessary accessory items for interconnection of the units *(see figure 38)*. The control boxes are mounted at the pilot's right. With the fuselage tank installed, one transmitter and two receivers are installed on the upper radio support, providing a transmitting range from 4000 to 5300 kcs and a receiving range from 190 to 550 kcs and 3000 to 6000 kcs. When the fuselage tank is not installed, an additional transmitter and receiver may be mounted on the fixed radio shelf, extending the transmitting range from 5300 to 7000 kcs and the receiving range from 6000 to 9100 kcs.

(b) TRANSMITTER.—The transmitter control box contains three switches, marked "TRANS. POWER," "TRANSMITTER SELECTOR," and "TONE-CW-VOICE." The switch marked "TRANSMITTER SELECTOR" has four divisions, two of which are used. Markings on the "TONE-CW-VOICE" switch indicate the type of signal being transmitted. With the switch turned to the "TONE" position, a signal is transmitted which is practically 100% modulated at 1000 cycles. With the switch turned to the "CW" position, a "continuous wave" or unmodulated signal will be transmitted. With the switch turned to the "VOICE" position, the microphone will be operative and voice will be transmitted when the push-to talk button on the throttle lever is pressed. For long-range communication, "CW" is most effective, "TONE" next, and "VOICE" least effective. The microphone is inoperative on both the "CW" and "TONE" positions, and code signals may be transmitted by a key on top the transmitter control box. If desired, a separate key may be plugged into the jack marked "KEY."

(c) RECEIVER.—The receiver control box is divided into three sections. A signal of specific frequency is received by using the section of the receiver control box which controls the particular receiver involved.

(2) OPERATION.

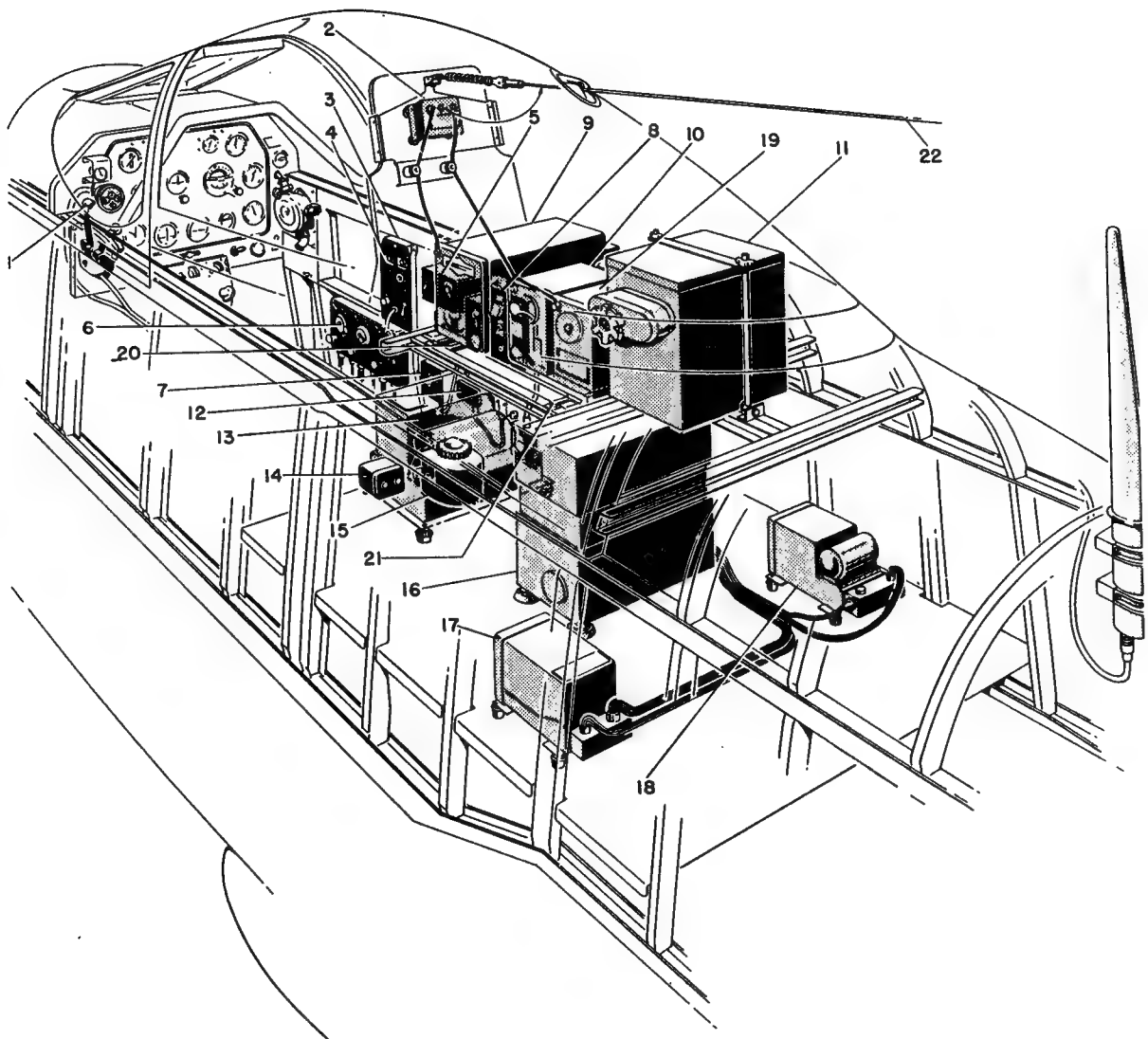
(a) TRANSMISSION.—Switch "ON" transmitter power switch, select one of the two transmitters, and turn "TONE-CW-VOICE" switch to the desired position.

(b) RECEPTION.—Turn on switch in upper right-hand corner of the control box section used. This switch, in addition to having an off position, has two selective positions marked "CW" and "MCW," each of which is an on position and indicates the type of signal to be received. To increase the volume of the signal, turn the knob in the lower left corner of the control section in a clockwise direction.

d. IDENTIFICATION EQUIPMENT.—The identification equipment is controlled from a box aft of the right-hand switch panel. For operating instructions, see the communications officer in charge. Detonator buttons and an inertia crash switch are provided with this equipment.

WARNING

Insert destructor plug only when the airplane is ready to take off. Remove plug immediately after landing.



1. THROTTLE SWITCH
2. BC-442 ANTENNA RELAY
3. 106-71154 PANEL ASSEMBLY
4. SCR-515 DETONATOR BUTTONS
5. BC-451-A TRANSMITTER CONTROL BOX
6. BC-450-A RECEIVER CONTROL BOX
7. FL-8 FILTER BOX
8. SCR-515 CONTROL BOX
9. BC-457 TRANSMITTER
10. BC-453 RECEIVER
11. BATTERY
12. MC-385 MICROPHONE ADAPTOR
13. BC-456 MODULATOR UNIT
14. INDICATOR LIGHTS SCR-515
15. INERTIA SWITCH SCR-515
16. SCR-515 RADIO SET
17. BC-458 TRANSMITTER
18. BC-455 RECEIVER
19. BC-454 RECEIVER
20. 106-71131 CHANNEL SUPPORT
21. 109-71132 CHANNEL SUPPORT
22. SCR-274-N ANTENNA

Figure 38—SCR-274-N and SCR-515 Radio Equipment

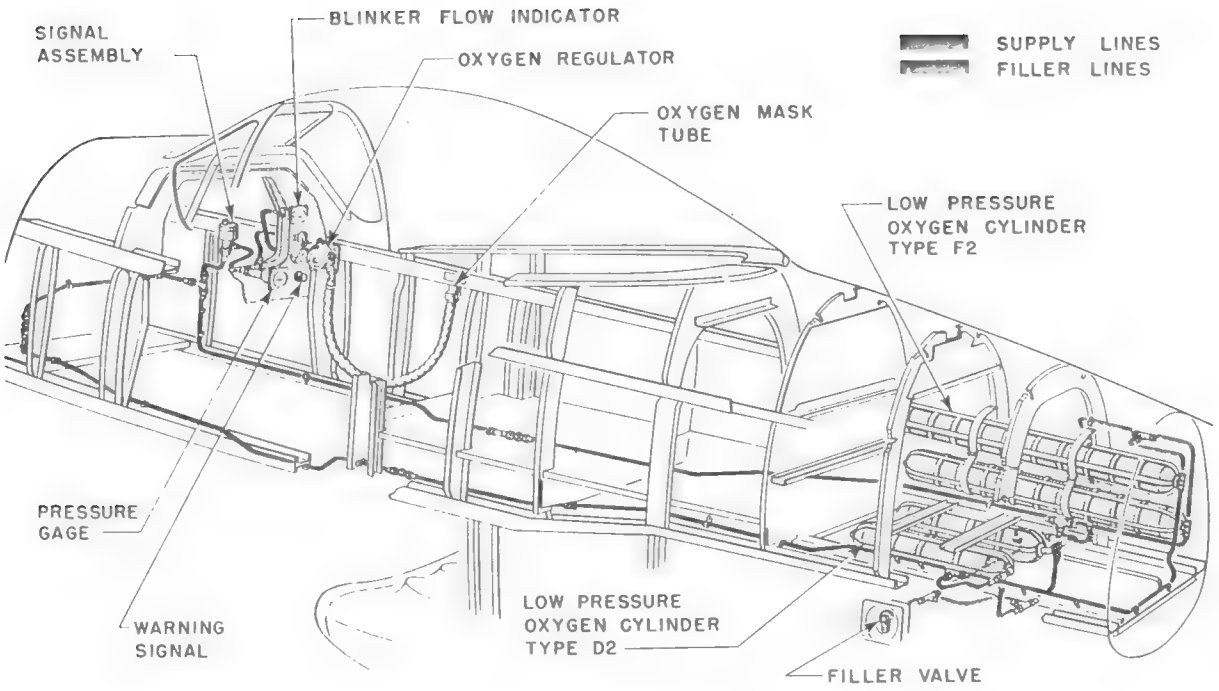


Figure 39—Oxygen System

e. PYROTECHNIC RECOGNITION SIGNAL PISTOL.

(1) DESCRIPTION. AN-M-8 pyrotechnic pistol is stowed in a canvas holster strapped to the pistol cartridge stowage bag on the upper left longeron, forward of the pilot's seat. A pistol mount is at the pilot's left. A cap, chained to the mount, covers the port when the pistol is not installed.

(2) OPERATION.

(a) Remove cover cap from mount.

(b) Insert muzzle of pistol in the mount so that the lugs on the pistol barrel slip into the slots; then, while depressing the mount release trigger, turn the pistol to right or left as far as it will go.

(c) To load pistol, press breech lock lever, behind the mount release trigger, and apply force on the butt until the breech opens. Then insert signal into the chamber and close breech. Pistol is cocked automatically when breech is closed.

WARNING

Do not load pistol except when it is in the mount, since no safety is provided.

f. SIGNAL LAMP.—A Type AN-3089 signal lamp may be stowed on a bracket on the left side of the cockpit floor. An electrical receptacle for the lamp is located on the extreme upper right side of the cockpit behind the pilot's seat. Colored filters may be used with the lamp.

g. RECOGNITION LIGHTS.—For operation of recognition lights, see Section II, paragraph 23, *a.* (5).

4. OXYGEN SYSTEM.

a. DESCRIPTION.—Oxygen is supplied from two Type D-2 and two Type F-2 low pressure oxygen cylinders. A Type A-12 demand regulator, cylinder pressure gage, low-pressure warning signal, and flow indicator are in the cockpit *(see figure 39)*. A Type A-9, A-9A, A-10, or B-14 mask may be used with this equipment. The blinker flow indicator operates with the breathing of the wearer, indicating proper functioning of the system. When the pressure of the cylinders drops to the danger point (100 lbs./sq. in.), a signal lamp on the instrument panel illuminates. The oxygen cylinders may be refilled without removal from the airplane by means of a filler valve on the left rear side of the fuselage. Normal full pressure of the system is 365 lbs./sq. in. See figure 40 for oxygen consumption chart.

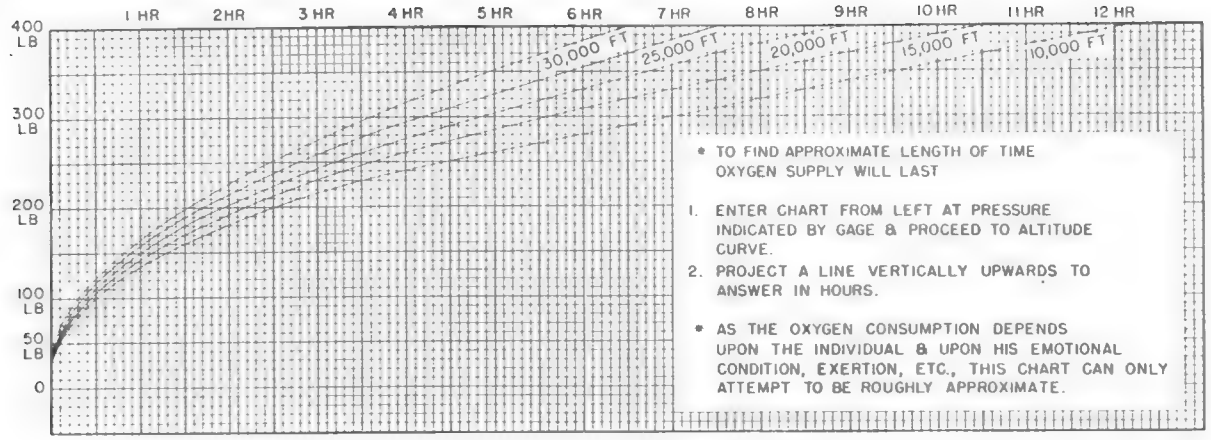


Figure 40—Oxygen Consumption Chart

b. OPERATION.

(1) PREFLIGHT CHECK.

(a) See that mask is properly fitted and check for leakage by holding the thumb over the corrugated hose fitting and inhaling normally. See that mask is clean.

(b) Check mask fitting to see that gasket is in place; then insert fitting into the end of the tubing from the regulator. Be sure the fit is snug and that a pull of at least 10 pounds is required to separate the two.

(c) Inspect mask regulator tubing for damage. Make sure all clamps are firmly in place.

(d) Attach the spring clip on the tubing to the clothing or parachute harness high up on the chest. It may be desirable to sew a tab of fabric or webbing to the clothing to accommodate the clip. Be sure that the attachment is high enough to permit free movement of the head without kinking the mask hose.

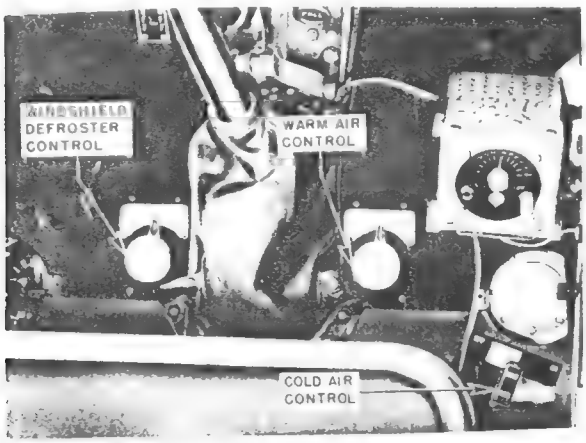


Figure 41—Heating, Ventilating, and Defrosting Controls

(e) Make certain the knurled collar at the outlet end of the regulator is tight. Examine top diaphragm to see that it is not ruptured or distorted.

(f) Turn emergency knob "ON" to check the flow. Check the pressure gage to see that there is no perceptible pressure drop. Turn emergency knob "OFF" and ascertain that it does not leak. Leave it in this position.

(g) Turn the auto-mix to "OFF." Note on flow indicator that on inhalation the top diaphragm goes down and that nearly 100 percent oxygen is received. Turn the auto-mix to "ON" and note that there is little or no indication of oxygen flow on the indicator. Leave in this position.

(h) Check that pressure of the system is not less than 365 lbs./sq. in. Before take-off, make certain that the pressure gage shows sufficient oxygen supply for the mission.

(2) DURING FLIGHT.

(a) If ice forms on mask, manipulate the mask at regular intervals to free it from ice.

(b) Be sure hose does not become kinked or twisted.

(c) If a lack of oxygen is experienced, turn "ON" red emergency knob on regulator.

(d) Check pressure gage and flow indicator frequently.

(e) In any flight over 30,000 feet, pay particular attention to oxygen equipment. Be sure all units and instruments are functioning perfectly before attempting flight

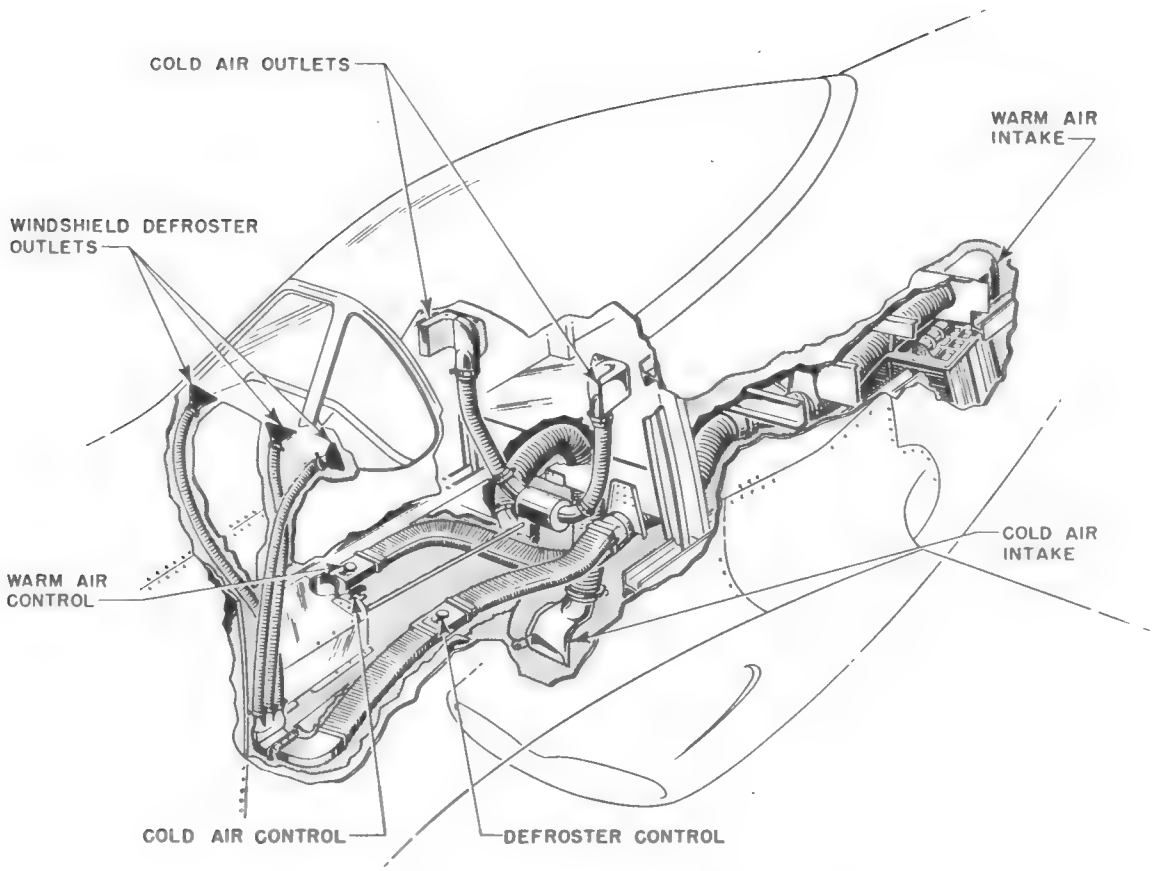


Figure 42—Heating, Ventilating, and Defrosting Systems

to extremely high altitudes. Any failure of the equipment may be fatal.

(3) AFTER FLIGHT.

(a) Be sure all oxygen equipment is in proper condition before leaving airplane. If any difficulties have developed during flight, take necessary steps to have them corrected.

(b) If oxygen pressure is below 100 lbs./sq. in., see that the supply warning light is on. If the pressure is slightly above 100 lbs./sq. in., bleed oxygen out of system by turning red emergency knob to "ON" and see that the supply warning light goes on at about 100 lbs./sq. in. Turn emergency knob to "OFF."

(c) Wash mask with mild soap and water, dry thoroughly, and leave in a clean airy place out of the sunlight.

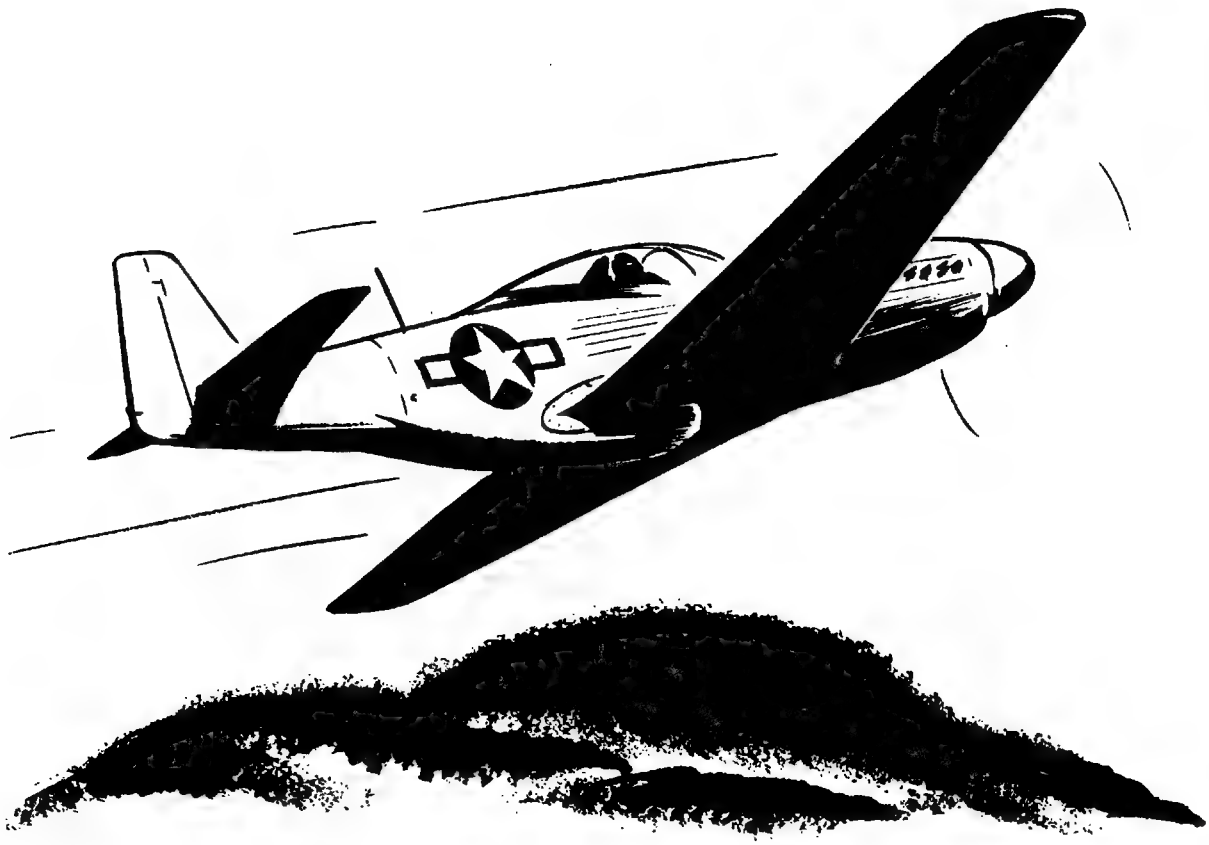
NOTE

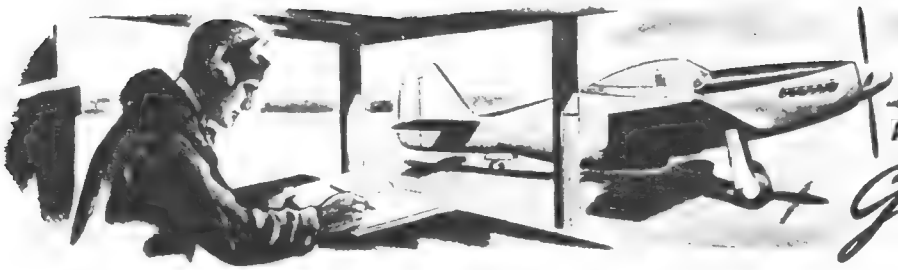
The oxygen mask will not stand abuse. See that the mask is properly stored or hung up in the airplane when not in use. Exposure of the mask to sunlight causes rapid deterioration.

5. HEATING, VENTILATING, AND DEFROSTING SYSTEM.

a. COCKPIT HEATING AND DEFROSTING.—Warm air from aft of the coolant radiator is utilized to heat the cockpit and to defrost the windshield and left side window *(see figure 42)*. The cockpit hot air control is on the floor at the right of the control column; the defroster control is on the floor at the left of the control column. To admit warm air turn desired control to the right, toward "ON."

b. COCKPIT VENTILATION.—Air from the forward section of the radiator air scoop is used to cool the cockpit. The cold air control is on the floor at the right side of the pilot's seat. Cold air outlets are located behind the pilot's seat.





APPENDIX I
Glossary

AMERICAN TERMINOLOGY	BRITISH TERMINOLOGY
Accumulator	Pressure Reservoir
Battery	Accumulator
Carburetor	Carburettor
Cockpit Enclosure	Cockpit Hood
Control Stick	Control Column
Empennage	Tail Unit
Engine (Power Plant)	Aero-Engine
Firewall	Fireproof Bulkhead
Indicated Airspeed	Air-Speed-Indicator Reading
Land	Alight
Landing Gear	Undercarriage
Left	Port
Lines	Pipes
Manifold Pressure	Boost
Mooring Rings	Picketing Rings
Radio	Wireless
Right	Starboard
Shock Strut	Oleo Leg
Surface Control Lock	Locking Gear
Surface Controls	Flying Controls
Windshield	Windscreen
Wing	Main Plane

APPENDIX II

Flight Operating Charts

1. FLIGHT PLANNING.

a. GENERAL.

(1) A series of charts on the following pages is provided to aid in selecting the proper power and altitude to be used for obtaining optimum range of the airplane. Charts are provided for each airplane configuration with the probable ranges of gross weights.

NOTE

Two sets of Flight Operation Instruction Charts are provided. The first set of charts *(figures 44 through 50)* is applicable to airplanes with V-1650-7 engines; the second set *(figures 51 through 57)* applies to airplanes which have had V-1650-3 engines installed in service.

(2) If the flight plan calls for a continuous flight where the desired cruising power and airspeed are reasonably constant after take-off and climb and the external load items are the same throughout the flight, the fuel required and flight time may be computed as a single section flight. If this is not the case, the flight should be broken up into sections, and each leg of the flight planned separately, since dropping of external bombs or tanks causes considerable changes in range and airspeed for given power. (Within the limits of the airplane, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in an airplane, speed is obtained at a sacrifice of range, and range is obtained at a sacrifice of speed.)

b. USE OF CHARTS.

(1) Although instructions for their use are shown on the Flight Operation Instruction Charts, the following expanded information on proper use of the charts may be helpful.

(2) Select the Flight Operation Instruction Chart for the model airplane, gross weight, and external loading to be used at take-off. The amount of gasoline available for flight planning purposes depends upon the reserve required and the amount required for starting and warm-up. The fuel required for warm-up and initial climb is set forth on the chart. Reserve should be based on the type of mission, terrain over which the flight is to be made, and weather conditions. The fuel required for climb and time to climb to various altitudes is shown on the Take-off, Climb, and Landing Chart. Fuel remaining after subtracting reserve, warm-up, and climb fuel from total amount available is the amount to be used for flight planning.

(3) Select a figure in the fuel column in the upper section of the chart equal to, or the next entry less than, the amount of fuel available for flight planning. Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the distance (with no wind) to be flown. Operating values contained in the lower section of the column number in which this figure appears represent the highest cruising speeds possible at the range desired. It will be noted that the ranges listed in column I are correct only at sea level and are conservative for higher altitudes. The ranges shown in column II and other columns to the right of column II can be obtained at any of the altitudes listed in the Altitude column. All of the power settings listed in a column will give approximately the same number of miles per gallon if each is used at the altitude shown on the same horizontal line with it. Note that the time required for the flight may be shortened by selection of the higher altitudes. In long-range cruising it is important that altitude, airspeed, and rpm be held constant. The manifold pressure should be changed as required to hold the above values reasonably constant. The flight duration may be obtained by dividing the true airspeed of the flight altitude into the air miles to be flown.

(4) The flight plan may be readily changed at any time en route, and the chart will show the balance of range available at various cruising powers by following the Instructions for Using Chart printed on each chart.

IMPORTANT

The above instructions and following charts do not take into account the effect of wind. Adjustments to range values and flight duration to allow for wind may be made by any method familiar to the pilot, such as by the use of a flight calculator or a navigator's triangle of velocities.

SPEC. AN-H-8 Dec. 15, 1942 FORM ASC-510

AIRPLANE MODELS
P-510

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
V-1650-7

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND MPH		HARD SURFACE RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND RUN	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND RUN	AT 6,000 FT. TO CLEAR 50' OBJ.	SOD-TURF RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND RUN	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND RUN	AT 6,000 FT. TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND RUN	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND RUN	AT 6,000 FT. TO CLEAR 50' OBJ.
9000	0		1400	2000	1500	2200	1700	2500	1400	2100	1600	2300	1800	2500	1600	2300	1800	2500	2000	2800
	17		1000	1600	1200	1700	1300	2000	1100	1600	1200	1800	1400	2000	1200	1800	1300	1900	1500	2200
	34		700	1200	800	1300	1000	1500	800	1200	900	1400	1000	1500	900	1300	900	1400	1100	1700
	51		500	800	600	1000	700	1100	500	900	600	1000	700	1100	600	900	600	1000	800	1200
10,000	0		1600	2400	1800	2500	2000	2800	1700	2400	1800	2600	2100	3000	1900	2700	2100	2900	2400	3200
	17		1200	1800	1300	2000	1500	2300	1300	1900	1400	2100	1600	2400	1400	2100	1600	2300	1800	2500
	34		900	1400	1000	1500	1100	1800	900	1400	1000	1600	1200	1800	1000	1600	1200	1700	1300	2000
	51		800	1000	700	1100	800	1300	600	1000	700	1200	800	1300	700	1100	800	1200	900	1500
11,000	0		1800	2700	2000	3000	2300	3300	2000	2800	2100	3100	2400	3400	2300	3200	2500	3400	2800	3900
	17		1400	2100	1500	2300	1800	2600	1500	2200	1600	2400	1900	2700	1700	2500	1900	2700	2200	3100
	34		1000	1600	1100	1800	1300	2100	1100	1700	1200	1900	1400	2100	1200	1900	1400	2100	1600	2400
	51		700	1200	800	1300	900	1500	700	1200	800	1400	1000	1600	800	1300	1000	1500	1200	1700

NOTE: INCREASE DISTANCE 5 % FOR EACH 10°C ABOVE 0°C (5 % FOR EACH 20°F ABOVE 32°F) ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 61 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 2700 RPM & 46 IN. HG — FERRY MISSIONS USE 2400 RPM & 36 IN. HG

	TYPE OF CLIMB	S. L. TO 5000 FT. ALT. BEST I.A.S. MPH		FT/MIN	TIME FROM S.L.	10,000 FT. ALT. BEST I.A.S. MPH		FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.		15,000 FT. ALT. BEST I.A.S. MPH		FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.		20,000 FT. ALT. BEST I.A.S. MPH		FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.		25,000 FT. ALT. BEST I.A.S. MPH		FT/MIN	TIME FROM S.L.	FUEL FROM S.L. U.S.		BLOWER CHANGE
11,000	COMBAT	165		1600	3.3	165		1630	6.5	28		165		1270	9.5	34		160		1150	13.5	41		155		950	18.5	51		AUTO.
	FERRY	165		730	0.8	165		780	13.6	30		165		730	20.5	37		165		450	29.0	47		160		200	43.0	64		AUTO.
10,000	COMBAT	165		1980	2.6	165		2030	5.2	26		165		1650	7.8	31		160		1560	10.6	36		155		1350	14.0	43		AUTO.
	FERRY	165		1030	1.8	165		1090	9.5	26		165		1050	14.5	31		165		750	20.0	37		160		530	28.0	46		AUTO.
9000	COMBAT	165		2350	2.1	165		2430	4.2	24		165		2000	6.4	28		160		1850	8.8	33		155		1750	11.5	38		AUTO.
	FERRY	165		1300	3.0	165		1400	7.5	24		165		1350	11.0	28		165		1050	14.0	33		160		850	21.0	39		AUTO.

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (5 % FOR EACH 20°F ABOVE 32°F) FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH MPH		HARD DRY SURFACE: AT SEA LEVEL TO CLEAR 50' OBJ.	AT SEA LEVEL GROUND ROLL	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND ROLL	AT 6,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND ROLL	FIRM DRY SOD: AT SEA LEVEL TO CLEAR 50' OBJ.	AT SEA LEVEL GROUND ROLL	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND ROLL	AT 6,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND ROLL	WET OR SLIPPERY: AT SEA LEVEL TO CLEAR 50' OBJ.	AT SEA LEVEL GROUND ROLL	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND ROLL	AT 6,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND ROLL
8000	110		2100	1100	2200	1200	2400	1400	2200	1300	2400	1400	2600	1500	3800	2900	4100	3100	4500	3400
9000	115		2300	1200	2400	1400	2600	1500	2400	1400	2500	1600	2800	1700	4300	3200	4600	3500	5000	3900

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS 9000 POUNDS IS WITH NO EXTERNAL LOAD
10,000 AND 11,000 POUNDS ARE WITH BOMBS OR EXTERNAL TANKS.

Legend
I.A.S.: Indicated Air Speed
M.P.H.: Miles Per Hour
S.L.: Sea Level
U.S.: U. S. Gallons
IMP.: Imperial Gallons
NOTE: All Distances are Average
RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

Figure 43—Take-off, Climb, and Landing Chart

MODEL(S) P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9600 TO 8000 POUNDS

EXTERNAL LOAD ITEMS

WING BOMB RACKS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I									II									III									IV									V							
RANGE IN AIR MILES							FUEL U. S. GAL.		RANGE IN AIR MILES								FUEL U. S. GAL.	RANGE IN AIR MILES								FUEL U. S. GAL.	RANGE IN AIR MILES								FUEL U. S. GAL.	RANGE IN AIR MILES							
STATUTE			NAUTICAL						STATUTE			NAUTICAL						STATUTE			NAUTICAL						STATUTE			NAUTICAL						STATUTE			NAUTICAL				
680			590				269		820			710						950			820						1120			970						1270			1100				
							240																																				
590			510				210		720			620						830			720						980			850						1110			960				
510			440				180		610			530						710			610						840			730						950			830				
420			370				150		510			440						590			510						700			610						790			690				
340			290				120		410			350						470			410						560			480						640			550				
250			220				90		300			260						350			310						420			360						480			420				
170			140				60		200			170						230			200						280			240						320			280				
80			70				30		100			90						110			100						140			120						160			140				
MAXIMUM CONTINUOUS							ALT. Feet		OPERATING DATA								ALT. Feet	OPERATING DATA								ALT. Feet	OPERATING DATA								ALT. Feet	MAXIMUM RANGE							
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.			R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.				R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.				R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.				R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.			
							40000										40000									40000									40000								
2700	230	AR	FT	80	400		35000										35000									35000									35000	2550	205	AR	FT	62	360		
2700	265	AR	FT	105	420		30000										30000	2600	255	AR	FT	90	410			30000	2500	245	AR	FT	75	390			30000	2350	205	AL	FT	58	340		
2700	280	AR	46	115	410		25000										25000	2400	260	AR	FT	87	380			25000	2400	245	AL	36	70	360			25000	2100	205	AL	FT	52	305		
2700	290	AR	FT	100	390		20000										20000	2600	270	AR	FT	84	370			20000	2350	245	AL	FT	64	335			20000	2050	205	AL	FT	48	280		
2700	305	AR	46	113	385		15000	2550	290	AR	FT	97	365				15000	2400	270	AR	39	78	340			15000	2150	250	AL	FT	61	315			15000	1800	205	AL	FT	44	260		
2700	305	AR	46	108	355		10000	2500	285	AR	43	88	335				10000	2400	270	AR	38	73	315			10000	2150	250	AL	36	57	295			10000	1650	210	AL	FT	42	245		
2700	305	AR	46	103	330		5000	2500	285	AR	43	82	310				5000	2400	270	AR	38	66	290			5000	2150	250	AL	36	54	275			5000	1600	210	AL	33	39	230		
2700	305	AR	46	98	310		S. L.	2550	285	AR	43	77	290				S. L.	2400	270	AR	38	63	270			S. L.	2150	250	AL	36	48	250			S. L.	1600	200	AL	31	34	200		

I 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT I

NOTES

I ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D

2. IF 85 GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9400 LB GROSS W.T. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT AIRMILES AT 20,000 FT. ALT MAINTAIN 2350 RPM AND 245 MPH IND AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 44—Flight Operation Instruction Chart—V-1650-7 Engine (Wing Bomb Racks—9600 to 8000 lbs.)

MODEL(S): P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,000 TO 9500 POUNDS

EXTERNAL LOAD ITEMS

2 - 300-LB. WING BOMBS (OR SMALLER SIZE)

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
				[29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ①												
650	560		269 240	790	680		910	790		1070	930		269 240	1240	1080	
590	510		220	720	620		840	730		990	850		220	1140	990	
540	470		200	650	570		760	660		890	770		200	1030	900	
480	420		180	590	510		680	590		800	690		180	930	810	
430	370		160	520	450		610	530		710	620		160	830	720	
380	330		140	460	400		530	460		620	540		140	730	630	

MAXIMUM CONTINUOUS							OPERATING DATA						OPERATING DATA						OPERATING DATA							MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000 35000 30000																			40000 35000 30000						
2700	270	AR	46	115	395	25000							2450	255	AR	41	86	375	2400	235	AR	37	71	350	25000	2100	200	AL	FT	53	295
2700	275	AR	FT	100	375	20000							2550	260	AR	FT	83	355	2400	240	AL	FT	67	330	20000	2050	200	AL	FT	48	275
2700	290	AR	46	113	365	15000	2550	280	AR	FT	96	350	2400	260	AR	39	78	330	2200	245	AL	FT	63	310	15000	1800	200	AL	FT	45	255
2700	290	AR	46	108	340	10000	2550	280	AR	43	89	325	2400	260	AR	38	72	305	2200	250	AL	36	59	290	10000	1650	205	AL	FT	42	240
2700	290	AR	46	103	315	5000	2550	275	AR	43	82	300	2400	260	AR	38	67	280	2250	250	AL	36	55	270	5000	1600	205	AL	33	39	225
2700	290	AR	46	98	295	S. L.	2500	275	AR	42	75	275	2400	260	AR	38	63	260	2300	250	AL	36	51	250	S. L.	1600	210	AL	33	37	210

NOTES

① ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLON FUSELAGE TANK IS INSTALLED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9800 LB GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2200 RPM AND 250 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 45—Flight Operation Instruction Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—10,000 to 9500 lbs.)

MODEL(S): P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9500 TO 8000 POUNDS

EXTERNAL LOAD ITEMS

2 - 300-LB. WING BOMBS
(OR SMALLER SIZE)

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II				III				IV				FUEL	V						
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES				RANGE IN AIR MILES				RANGE IN AIR MILES				U. S.	RANGE IN AIR MILES						
STATUTE		NAUTICAL	GAL.	STATUTE		NAUTICAL		STATUTE		NAUTICAL		STATUTE		NAUTICAL		GAL.	STATUTE		NAUTICAL				
			184	1 24 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT												184							
430		370	160	500		430		600		520		720		620		160	850		740				
380		330	140	440		380		530		460		630		540		140	740		650				
320		280	120	380		330		450		390		540		460		120	640		550				
270		230	100	310		270		380		330		450		390		100	530		460				
210		180	80	250		220		300		260		360		310		80	430		370				
160		140	60	190		160		220		190		270		230		60	320		280				
110		90	40	120		110		150		130		180		150		40	220		190				
50		40	20	60		50		70		60		90		70		20	110		100				
MAXIMUM CONTINUOUS																							
R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	OPERATING DATA																
						40000																	
						35000																	
						30000																	
2700	270	AR	46	115	395	25000						2450	255	AR	41	89	375	2400	240	AR	37	71	355	25000	2100	205	AL	FT	52	305
2700	275	AR	FT	100	375	20000						2550	260	AR	FT	84	355	2400	240	AL	FT	66	330	20000	2050	205	AL	FT	49	285
2700	290	AR	46	113	365	15000	2550	280	AR	FT	100	350	2400	260	AR	39	79	330	2200	245	AL	FT	62	310	15000	1800	205	AL	FT	45	260
2700	290	AR	46	108	340	10000	2550	280	AR	43	93	325	2400	260	AR	38	73	305	2250	250	AL	36	58	290	10000	1650	210	AL	FT	42	245
2700	290	AR	46	103	315	5000	2550	280	AR	43	86	300	2400	260	AR	38	67	280	2250	250	AL	36	54	270	5000	1600	210	AL	33	40	230
2700	290	AR	46	98	295	S. L.	2550	280	AR	43	80	280	2400	260	AR	38	62	260	2250	250	AL	36	50	250	S. L.	1600	210	AL	32	37	210

NOTES

T ALLOW 24 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND RESERVE & COMBAT AS REQ'D

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9300 LB GROSS WT. WITH 160 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 GAL.) TO FLY 550 STAT AIRMILES AT 10,000 FT. ALT MAINTAIN 2250 RPM AND 250 MPH IND AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 46—Flight Operation Instruction Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—9500 to 8000 lbs.)

MODEL(S): P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,500 TO 10,000 POUNDS

EXTERNAL LOAD ITEMS: 2 - 500-LB. WING BOMBS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW / HIGH	AR	5	194 / 187
MILITARY POWER	3000	61	LOW / HIGH	AR	15	178 / 170
NORMAL RATED	2700	46	LOW / HIGH	AR	CONT.	108 / 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
				[1] 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT [2]												
630	*540*		269 240	760	*660*		870	*760*		1020	*890*		269 240	1180	*1020*	
570	*500*		220	700	*610*		800	*690*		940	*810*		220	1080	*940*	
520	*450*		200	640	*550*		730	*630*		850	*740*		200	980	*850*	
470	*410*		180	570	*500*		650	*570*		770	*660*		180	880	*770*	
420	*360*		160	510	*440*		580	*500*		680	*590*		160	790	*680*	
370	*320*		140	440	*390*		510	*440*		600	*520*		140	690	*600*	

MAXIMUM CONTINUOUS						ALT. Feet	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT. Feet	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.		R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.		R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000 35000 30000																			40000 35000 30000						
2700	260	AR	46	115	385	25000							2500	245	AR	41	91	365	2400	235	AR	38	73	345	25000	2150	200	AL	FT	55	295
2700	265	AR	FT	100	360	20000							2600	255	AR	FT	87	350	2450	240	AR	FT	69	325	20000	2100	200	AL	FT	51	275
2700	280	AR	46	113	355	15000	2550	270	AR	FT	95	340	2400	255	AR	FT	80	325	2250	240	AL	36	65	305	15000	1900	205	AL	FT	48	260
2700	280	AR	46	108	330	10000	2500	270	AR	42	89	315	2400	255	AR	39	73	300	2300	245	AL	36	61	285	10000	1650	210	AL	FT	46	245
2700	280	AR	46	103	305	5000	2500	270	AR	42	82	290	2400	255	AR	38	67	275	2350	245	AL	36	56	265	5000	1600	210	AL	36	43	230
2700	280	AR	46	98	285	S. L.	2500	270	AR	42	76	270	2400	255	AR	38	63	255	2350	245	AL	36	52	245	S. L.	1600	210	AL	34	41	210

NOTES

[1] ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

EXAMPLE

AT 10,300 LB. GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 950 STAT AIRMILES AT 10,000 FT. ALT. MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

HIGH BLOWER ABOVE HEAVY LINE ONLY.

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 47—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,500 to 10,000 lbs.)

MODEL(S) P-51D

FLIGHT OPERATION INSTRUCTION CHART

EXTERNAL LOAD ITEMS

2 - 500-LB. WING BOMBS

ENGINE(S): V-1650-7

CHART WEIGHT LIMITS: 10,000 TO 8500 POUNDS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
420	*360*		184	① 24 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT									184	800	*740*	
370	*320*		160 140	500	*430*		580	*500*		680	*590*		160 140	700	*610*	
310	*270*		120	370	*320*		430	*380*		510	*440*		120	600	*520*	
260	*230*		100	310	*270*		360	*310*		420	*370*		100	500	*440*	
210	*180*		80	250	*210*		290	*250*		340	*290*		80	400	*350*	
150	*130*		60	180	*160*		210	*190*		250	*220*		60	300	*270*	
100	*90*		40	120	*110*		140	*120*		170	*140*		40	200	*180*	
50	*40*		20	60	*50*		70	*60*		80	*70*		20	100	*90*	

MAXIMUM CONTINUOUS						ALT.	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT.	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. T. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2700	260	AR	46	115	385	25000							2450	245	AR	41	90	365	2400	235	AR	37	73	345	25000	2150	200	AL	FT	54	300
2700	270	AR	FT	100	365	20000							2550	255	AR	FT	85	345	2400	240	AL	FT	68	325	20000	2100	205	AL	FT	50	280
2700	280	AR	46	113	355	15000	2500	265	AR	FT	97	335	2400	255	AR	38	79	320	2250	240	AL	36	64	305	15000	1850	205	AL	FT	47	260
2700	280	AR	46	108	330	10000	2500	265	AR	42	89	310	2400	255	AR	38	73	295	2300	245	AL	36	60	285	10000	1700	210	AL	FT	44	245
2700	280	AR	46	103	305	5000	2500	270	AR	42	83	290	2400	255	AR	39	68	275	2350	245	AL	36	56	265	5000	1600	210	AL	35	42	230
2700	280	AR	46	98	285	S. L.	2550	270	AR	43	78	270	2400	255	AR	39	63	255	2350	245	AL	36	52	245	S. L.	1600	210	AL	34	39	210

NOTES

① ALLOW 24 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9800 LB. GROSS WT. WITH 160 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 GAL.) TO FLY 600 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 48—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,000 to 8500 lbs.)

MODEL(S) P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,700 TO 9600 POUNDS

EXTERNAL LOAD ITEMS

2 - 75-GALLON COMBAT TANKS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	① 3000	67	LOW HIGH	AR	5	194 137
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I		FUEL	II		III		IV		FUEL	V	
RANGE IN AIR MILES		U. S.	RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		U. S.	RANGE IN AIR MILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			① 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ①								
1000	*870*	419 390	1210	*1050*	1410	*1230*	*1610*	*1400*	419 390	1820	*1580*
920	*800*	360	1120	*970*	1310	*1130*	1490	*1290*	360	1680	*1460*
850	*730*	330	1020	*890*	1200	*1040*	1360	*1180*	330	1540	*1330*
770	*670*	300	930	*800*	1090	*940*	1240	*1070*	300	1400	*1210*
690	*600*	270	830	*720*	980	*850*	1110	*960*	270	1260	*1090*
610	*530*	240	740	*640*	870	*750*	990	*860*	240	1120	*970*

MAXIMUM CONTINUOUS						ALT.	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT.	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
2700	245	AR	FT	105	390	30000							2600	235	AR	FT	93	375	2500	225	AR	FT	78	360	30000	2400	195	AL	FT	61	315
2700	255	AR	46	115	375	25000							2400	235	AR	FT	87	350	2400	230	AR	37	74	340	25000	2200	200	AL	FT	57	295
2700	260	AR	FT	100	355	20000							2550	250	AR	FT	84	340	2400	230	AL	FT	69	315	20000	2150	200	AL	FT	54	275
2700	275	AR	46	113	345	15000	2500	260	AR	FT	96	330	2400	250	AR	39	78	315	2250	240	AL	36	65	300	15000	2000	210	AL	FT	52	265
2700	275	AR	46	108	320	10000	2500	260	AR	42	89	305	2400	250	AR	38	72	290	2300	240	AL	36	61	280	10000	1750	210	AL	FT	48	245
2700	275	AR	46	103	300	5000	2500	265	AR	42	83	285	2400	250	AR	38	67	270	2300	240	AL	36	57	260	5000	1600	205	AL	36	44	225
2700	275	AR	46	98	280	S. L.	2550	265	AR	43	75	265	2400	250	AR	38	62	250	2300	240	AL	36	52	240	S. L.	1600	200	AL	34	39	200

NOTES

① ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO COMBAT TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 10,500 LB. GROSS WT. WITH 390 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1500 STAT. AIRMILES AT 25,000 FT. ALT. MAINTAIN 2400 RPM AND 230 MPH IND AIRSPEED WITH MIXTURE SET AUTO RICH - HIGH BLOWER.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY. SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 49—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—10,700 to 9600 lbs.)

MODEL(S): P-51D

FLIGHT OPERATION INSTRUCTION CHART

EXTERNAL LOAD ITEMS: 2 - 75-GALLON COMBAT TANKS

ENGINE(S): V-1650-7

CHART WEIGHT LIMITS: 9600 TO 8000 POUNDS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	195 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
				① 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ①												
610	530		269	740	640		860	750		1040	900		269	1180	1020	
540	470		240	650	560		750	650		910	790		240	1030	890	
			210										210			
460	400		180	560	480		640	560		780	670		180	880	770	
380	330		150	460	400		540	460		650	560		150	740	640	
310	270		120	370	320		430	370		520	450		120	590	510	
230	200		90	280	240		320	280		390	340		90	450	390	
150	130		60	180	160		210	180		260	220		60	300	260	
70	60		30	90	80		100	90		130	110		30	150	130	

MAXIMUM CONTINUOUS						ALT.	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT.	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
2700	245	AR	FT	105	390	30000							2600	235	AR	FT	94	375	2500	225	AR	FT	75	360	30000	2350	190	AL	FT	57	310
2700	255	AR	46	115	375	25000							2450	240	AR	41	89	355	2400	225	AR	37	70	335	25000	2150	190	AL	FT	53	285
2700	260	AR	FT	100	355	20000							2550	250	AR	FT	85	340	2350	225	AL	FT	65	310	20000	2050	195	AL	FT	49	265
2700	275	AR	46	113	345	15000	2550	260	AR	FT	96	330	2400	250	AR	39	79	315	2200	235	AL	FT	62	295	15000	1850	200	AL	FT	46	250
2700	275	AR	46	108	320	10000	2550	260	AR	43	89	305	2400	250	AR	38	73	290	2150	235	AL	36	57	275	10000	1650	200	AL	FT	44	235
2700	275	AR	46	103	300	5000	2550	265	AR	43	83	285	2400	250	AR	38	68	270	2150	235	AL	36	53	255	5000	1600	200	AL	34	41	220
2700	275	AR	46	98	280	S. L.	2550	265	AR	43	77	265	2400	250	AR	38	63	250	2150	235	AL	36	49	235	S. L.	1600	205	AL	34	38	205

NOTES

① ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 90 GALLONS ARE USED BEFORE SWITCHING TO COMBAT TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9500 LB. GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 950 STAT. AIRMILES AT 20,000 FT. ALT. MAINTAIN 2350 RPM AND 225 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 50—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—9600 to 8000 lbs.)

Figures 56-64, pages 61-75, deleted in revision, dated 7 May 1947

AAFMC-527 8-1-44

AIRCRAFT MODEL(S)
P-51D AND P-51K

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
V-1650-3

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3000 FEET GROUND RUN	SOD-TURF RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6000 FEET GROUND RUN	SOD-TURF RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 3000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
9000	0	0	1350	2000	1500	2200	1700	2450	1450	2100	1600	2250	1800	2500	1600	2250	1750	2450	2000	2750
	17	15	1000	1550	1150	1700	1300	1950	1050	1600	1200	1800	1350	2000	1200	1750	1350	1900	1500	2200
	34	30	750	1150	800	1300	950	1500	750	1200	850	1350	1000	1550	850	1300	950	1400	1100	1650
	51	45	500	850	550	950	650	1100	500	850	600	1000	700	1150	550	900	600	1050	750	1200
11,000	0	0	1850	2700	2000	2950	2250	3300	1950	2800	2100	3050	2400	3400	2250	3150	2400	3400	2800	3800
	17	15	1350	2150	1500	2300	1750	2650	1450	2200	1600	2400	1850	2700	1700	2450	1900	2700	2150	3100
	34	30	950	1600	1100	1750	1300	2050	1050	1650	1200	1850	1400	2100	1200	1850	1400	2050	1600	2300
	51	45	650	1150	750	1250	900	1500	700	1200	800	1350	950	1550	800	1250	950	1500	1150	1750
13,000	0	0	2300	3600	2500	3800	2800	4300	2450	3700	2650	3950	3000	4550	2900	4300	3200	4800	3600	5300
	17	15	1700	2800	1900	3050	2200	3400	1850	2900	2050	3200	2350	3600	2200	3300	2400	3700	2800	4200
	34	30	1200	2050	1400	2300	1650	2700	1350	2150	1500	2400	1750	2850	1600	2450	1800	2850	2100	3200
	51	45	850	1550	1000	1750	1200	2100	900	1600	1050	1800	1300	2250	1100	1700	1300	2100	1550	2700

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F) 40%

OPTIMUM TAKE-OFF WITH 3000 RPM, 61 IN.HG. & 20 DEG.FLAP IS 80% OF CHART VALUES

DATA AS OF 5-8-45 BASED ON: FLIGHT TESTS

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL BEST I.A.S. MPH	AT SEA LEVEL BEST I.A.S. KTS	AT SEA LEVEL RATE OF CLIMB F.P.M.	AT SEA LEVEL GAL. OF FUEL USED	AT 5000 FEET BEST I.A.S. MPH	AT 5000 FEET BEST I.A.S. KTS	AT 5000 FEET RATE OF CLIMB F.P.M.	AT 5000 FEET FROM SEA LEVEL TIME MIN.	AT 5000 FEET FROM SEA LEVEL FUEL USED	AT 10,000 FEET BEST I.A.S. MPH	AT 10,000 FEET BEST I.A.S. KTS	AT 10,000 FEET RATE OF CLIMB F.P.M.	AT 10,000 FEET FROM SEA LEVEL TIME MIN.	AT 10,000 FEET FROM SEA LEVEL FUEL USED	AT 15,000 FEET BEST I.A.S. MPH	AT 15,000 FEET BEST I.A.S. KTS	AT 15,000 FEET RATE OF CLIMB F.P.M.	AT 15,000 FEET FROM SEA LEVEL TIME MIN.	AT 15,000 FEET FROM SEA LEVEL FUEL USED	AT 20,000 FEET BEST I.A.S. MPH	AT 20,000 FEET BEST I.A.S. KTS	AT 20,000 FEET RATE OF CLIMB F.P.M.	AT 20,000 FEET FROM SEA LEVEL TIME MIN.	AT 20,000 FEET FROM SEA LEVEL FUEL USED	AT 25,000 FEET BEST I.A.S. MPH	AT 25,000 FEET BEST I.A.S. KTS	AT 25,000 FEET RATE OF CLIMB F.P.M.	AT 25,000 FEET FROM SEA LEVEL TIME MIN.	AT 25,000 FEET FROM SEA LEVEL FUEL USED
9000	170	145	2200	15	170	145	2200	2.5	19	170	145	2250	5.0	23	170	145	2250	7.5	27	165	145	1900	10.0	31	160	140	1650	13.0	35
11,000	170	145	1500	15	170	145	1500	3.5	20	170	145	1500	7.0	26	170	145	1500	10.5	32	165	145	1150	15.0	39	160	140	900	19.0	47
13,000	175	150	1000	15	175	150	950	5.5	23	175	150	900	11.0	32	175	150	850	17.0	42	170	145	550	23.0	55	165	145	300	37.0	75

POWER PLANT SETTINGS: (DETAILS ON FIG. SECTION III):

DATA AS OF 5-8-45 BASED ON: FLIGHT TESTS

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH POWER OFF MPH	POWER OFF KTS	POWER ON MPH	POWER ON KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3000 FEET GROUND ROLL	HARD DRY SURFACE AT 3000 FEET TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6000 FEET GROUND ROLL	HARD DRY SURFACE AT 6000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3000 FEET GROUND ROLL	FIRM DRY SOD AT 3000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6000 FEET GROUND ROLL	FIRM DRY SOD AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3000 FEET GROUND ROLL	WET OR SLIPPERY AT 3000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6000 FEET GROUND ROLL	WET OR SLIPPERY AT 6000 FEET TO CLEAR 50' OBJ.
9000	130	115	130	115	1200	2300	1400	2400	1500	2600	1400	2400	1600	2600	1700	2800	3200	4300	3500	4600	3900	5000
8000	120	115	130	115	1100	2100	1200	2200	1400	2400	1300	2200	1400	2400	1500	2600	2900	3800	3100	4100	3400	4500

DATA AS OF 5-8-45 BASED ON: FLIGHT TESTS

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

MIXTURE: USE "RUN" OR "AUTO RICH - AUTO LEAN"

LEGEND

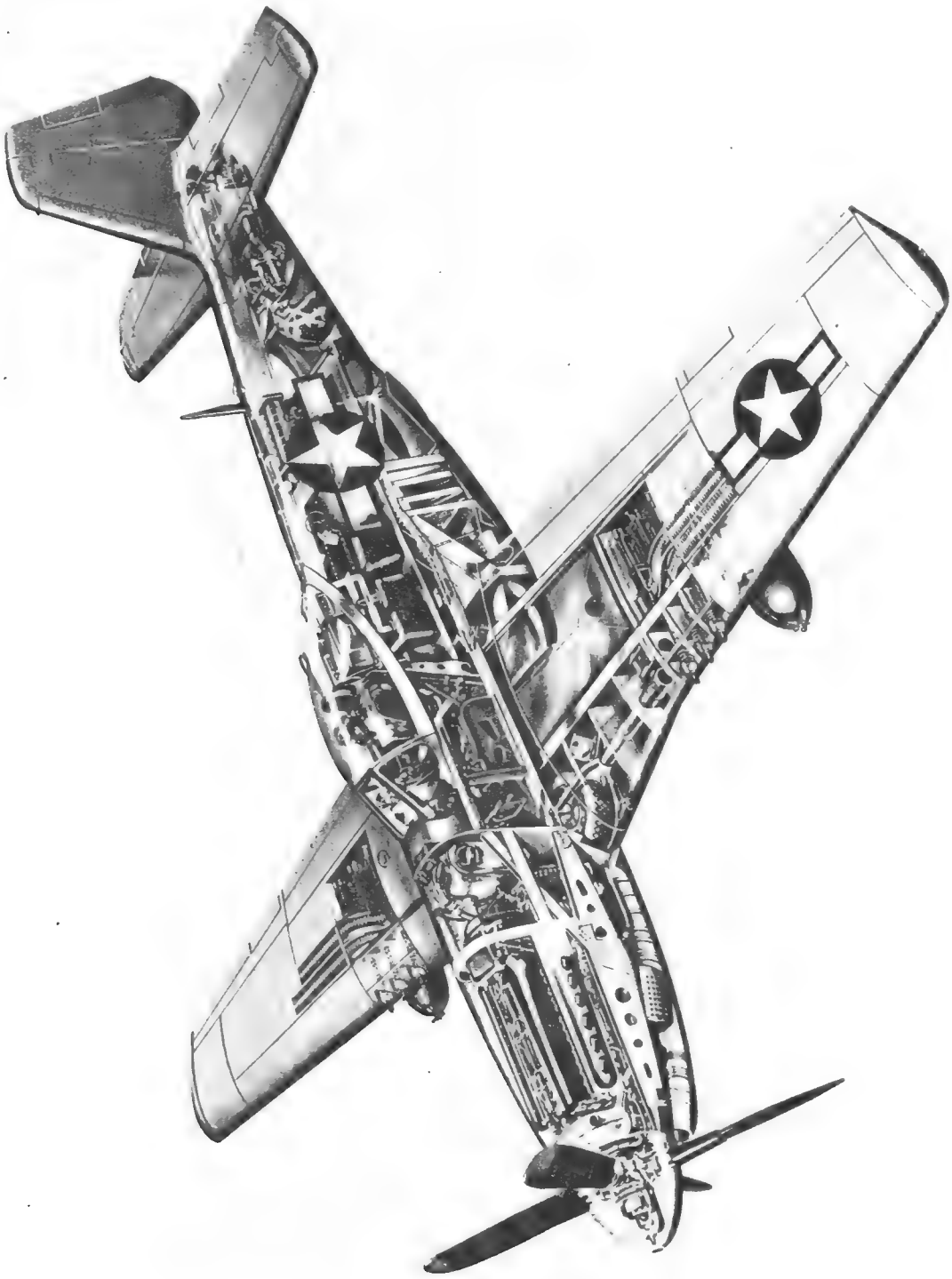
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure 64—Take-off, Climb and Landing Chart

For use with V-1650-3 engine only regardless of airplane model.

For use with V-1650-3 engine only regardless of airplane model.

For use with V-1650-3 engine only regardless of airplane model.



SPEC. AN-H-8 DEC. 18, 1942 FORM ASC-512

AIRPLANE MODELS: P-51D

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS: PACKARD V-1650-7

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	12-16	70-80	70-80	158-176	100-110	212-230		
MAXIMUM	19	90	90	194	121	250		
MINIMUM	12	50	15	59	60	140		
IDLING	9	15						

MAX. PERMISSIBLE DIVING RPM: 3240

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	11 U.S.QT/HR ..... IMP.PT/HR
MAX. CRUISE	4 U.S.QT/HR ..... IMP.PT/HR
MIN. SPECIFIC	3 U.S.QT/HR ..... IMP.PT/HR

OIL GRADE: (S) 1100 (W) 1100

SUPERCHARGER TYPE: TWO SPEED, TWO STAGE

FUEL GRADE: SPEC. AN-F-28 GRADE 130 OCTANE 100

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.		MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	61	1490		S.L.	LOW		A.R.	161				5
WAR EMERGENCY	3000	67	1720 1505		6,200 19,300	LOW HIGH		A.R. A.R.	194 187				5
MILITARY	3000	61	1590 1370		8,500 21,400	LOW HIGH		A.R. A.R.	178 170				15
MAXIMUM CONTINUOUS	2700	46	1180 1065		11,300 23,400	LOW HIGH		A.R. A.R.	109 106				CONT.
MAXIMUM CRUISE	2400	36	820 760		14,000 23,700	LOW HIGH		A.L. A.L.	66 64				CONT.
MINIMUM SPECIFIC CONSUMPTION													

REMARKS: *ADDITIONAL INFORMATION WILL BE INCORPORATED IN THIS CHART WHEN AVAILABLE.*

Figure 28—Specific Engine Flight Chart—V-1650-7

SPEC. AN-H-8
DEC. 18, 1942
FORM ASC-512

AIRPLANE MODELS P-51D

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS PACKARD V-1650-3

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	12-16	70-80	70-80	158-176	100-110	212-230		
MAXIMUM	19	90	90	194	121	250		
MINIMUM	12	50	15	59	60	140		
IDLING	9	15						

MAX. PERMISSIBLE DIVING RPM: 3240

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	.11. U.S.QT/HR. IMP.PT/HR
MAX. CRUISE	.4. U.S.QT/HR. IMP.PT/HR
MIN. SPECIFIC	.3. U.S.QT/HR. IMP.PT/HR

OIL GRADE: (S) 1100 (W) 1100

SUPERCHARGER TYPE: TWO SPEED, TWO STAGE

FUEL GRADE: SPEC. AN-F-28 GRADE 130 OCTANE 100

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.		MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	61	1400	S.L.	S.L.	LOW		AR	150				5
WAR EMERGENCY	3000	67	1595	17,000	11,700	LOW		AR	166				5
			1295	28,800	23,200	HIGH		AR	160				
MILITARY	3000	61	1450	19,800	13,700	LOW		AR	158				15
			1190	31,200	25,600	HIGH		AR	144				
MAXIMUM CONTINUOUS	2700	46	1120	20,500	17,500	LOW		AR	111				CONT.
			940	34,400	29,500	HIGH		AR	106				
MAXIMUM CRUISE	2400	36	800	21,500	18,500	LOW		AL	74				CONT.
	2400	36	700	32,300	30,500	HIGH		AL	70				
MINIMUM SPECIFIC CONSUMPTION	1600	27	370	S.L.		LOW		AL	35				CONT.
	1600	30	440	5,000		LOW		AL	39				
	1600	31	480	10,000		LOW		AL	42				
	1800	F.T.	510	15,000		LOW		AL	45				
	2000	F.T.	560	20,000		LOW		AL	50				

REMARKS: *DATA FOR MINIMUM SPECIFIC CONSUMPTION ARE FOR AVERAGE MAXIMUM RANGE CONDITIONS*

Figure 29—Specific Engine Flight Chart—V-1650-3

SPEC. AN-P-3 Nov. 15, 1943 FORM ASC-218

AIRPLANE MODELS
P-51D

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
V-1650-7

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND MPH		HARD SURFACE RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND RUN	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND RUN	AT 6,000 FT. TO CLEAR 50' OBJ.	SOD-TURF RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND RUN	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND RUN	AT 6,000 FT. TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY: AT SEA LEVEL GROUND RUN	AT SEA LEVEL TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND RUN	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND RUN	AT 6,000 FT. TO CLEAR 50' OBJ.
9000	0		1400	2000	1500	2200	1700	2500	1400	2100	1600	2300	1800	2500	1600	2300	1800	2500	2000	2800
	17		1000	1600	1200	1700	1300	2000	1100	1600	1200	1800	1400	2000	1200	1800	1300	1900	1500	2200
	34		700	1200	800	1300	1000	1500	800	1200	900	1400	1000	1500	900	1300	900	1400	1100	1700
	51		500	800	600	1000	700	1100	500	900	600	1000	700	1100	600	900	600	1000	800	1200
10,000	0		1600	2400	1800	2500	2000	2800	1700	2400	1800	2600	2100	3000	1900	2700	2100	2900	2400	3200
	17		1200	1800	1300	2000	1500	2300	1300	1900	1400	2100	1600	2400	1400	2100	1600	2300	1800	2500
	34		900	1400	1000	1500	1100	1800	900	1400	1000	1600	1200	1800	1000	1600	1200	1700	1300	2000
	51		600	1000	700	1100	800	1300	600	1000	700	1200	800	1300	700	1100	800	1200	900	1500
11,000	0		1800	2700	2000	3000	2300	3300	2000	2800	2100	3100	2400	3400	2300	3200	2500	3400	2800	3900
	17		1400	2100	1500	2300	1800	2800	1500	2200	1600	2400	1900	2700	1700	2500	1900	2700	2200	3100
	34		1000	1600	1100	1800	1300	2100	1100	1700	1200	1900	1400	2100	1200	1900	1400	2100	1600	2400
	51		700	1200	800	1300	900	1500	700	1200	800	1400	1000	1600	800	1300	1000	1500	1200	1700

NOTE: INCREASE DISTANCE 5 % FOR EACH 10°C ABOVE 0°C (5 % FOR EACH 20°F ABOVE 32°F) ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 61 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 2700 RPM & 46 IN. HG

FERRY MISSIONS USE 2400 RPM & 36 IN. HG

	TYPE OF CLIMB	S. L. TO 5000 FT. ALT. BEST I.A.S. MPH	FT/MIN	TIME FROM S. L.	10,000 FT. ALT. BEST I.A.S. MPH	FT/MIN	TIME FROM S. L.	FUEL FROM S.L. U. S.	15,000 FT. ALT. BEST I.A.S. MPH	FT/MIN	TIME FROM S. L.	FUEL FROM S.L. U. S.	20,000 FT. ALT. BEST I.A.S. MPH	FT/MIN	TIME FROM S. L.	FUEL FROM S.L. U.S.	25,000 FT. ALT. BEST I.A.S. MPH	FT/MIN	TIME FROM S. L.	FUEL FROM S.L. U.S.	BLOWER CHANGE
11,000	COMBAT	165	1600	3.3	165	1630	6.5	28	165	1270	9.5	34	160	1150	13.5	41	155	950	18.5	51	AUTO.
	FERRY	165	730	6.8	165	780	13.6	30	165	730	20.5	37	165	450	29.0	47	160	200	43.0	64	AUTO.
10,000	COMBAT	165	1980	2.6	165	2030	5.2	26	165	1650	7.8	31	160	1560	10.5	36	155	1350	14.0	43	AUTO.
	FERRY	165	1030	4.8	165	1090	9.5	28	165	1050	14.5	31	165	750	20.0	37	160	530	28.0	46	AUTO.
9000	COMBAT	165	2350	2.1	165	2430	4.2	24	165	2000	6.4	28	160	1950	8.8	33	155	1750	11.5	38	AUTO.
	FERRY	165	1300	3.0	165	1400	7.5	24	165	1350	11.0	28	165	1050	14.0	33	160	850	21.0	39	AUTO.

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (5 % FOR EACH 20°F ABOVE 32°F) FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT IN LBS.	BEST I. A. S. APPROACH MPH		HARD DRY SURFACE: AT SEA LEVEL TO CLEAR 50' OBJ.	AT SEA LEVEL GROUND ROLL	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND ROLL	AT 6,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND ROLL	FIRM DRY SOD: AT SEA LEVEL TO CLEAR 50' OBJ.	AT SEA LEVEL GROUND ROLL	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND ROLL	AT 6,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND ROLL	WET OR SLIPPERY: AT SEA LEVEL TO CLEAR 50' OBJ.	AT SEA LEVEL GROUND ROLL	AT 3,000 FT. TO CLEAR 50' OBJ.	AT 3,000 FT. GROUND ROLL	AT 6,000 FT. TO CLEAR 50' OBJ.	AT 6,000 FT. GROUND ROLL
8000	110		2100	1100	2200	1200	2400	1400	2200	1300	2400	1400	2600	1500	3800	2900	4100	3100	4500	3400
9000	115		2300	1200	2400	1400	2600	1500	2400	1400	2600	1600	2800	1700	4300	3200	4600	3500	5000	3900

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS 9000 POUNDS IS WITH NO EXTERNAL LOAD
10,000 AND 11,000 POUNDS ARE WITH BOMBS OR EXTERNAL TANKS.

LEGEND
I.A.S.: Indicated Air Speed
M.P.H.: Miles Per Hour
S.L.: Sea Level
U.S.: U. S. Gallons
IMP.: Imperial Gallons
NOTE: All Distances are Average
RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

Figure 43—Take-off, Climb, and Landing Chart

MODEL(S) P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9600 TO 8000 POUNDS

EXTERNAL LOAD ITEMS

WING BOMB RACKS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			II			III			IV			V														
RANGE IN AIR MILES		FUEL U.S. GAL.	RANGE IN AIR MILES		FUEL U.S. GAL.	RANGE IN AIR MILES		FUEL U.S. GAL.	RANGE IN AIR MILES		FUEL U.S. GAL.	RANGE IN AIR MILES			MAXIMUM CONTINUOUS						OPERATING DATA						OPERATING DATA						OPERATING DATA						MAXIMUM RANGE					
STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
			① 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ①											40000																					40000					
680	590	269	820	710	269	950	820	269	1120	970	269			35000	2700	230	AR	FT	80	400														35000	2550	205	AR	FT	62	360
		240			240			240			240																											
590	510	210	720	620	210	830	720	210	980	850	210			30000	2700	265	AR	FT	105	420	2600	255	AR	FT	90	410	2500	245	AR	FT	75	390	30000	2350	205	AL	FT	58	340
510	440	180	610	530	180	710	610	180	840	730	180			25000	2700	280	AR	46	115	410	2400	260	AR	FT	87	380	2400	245	AL	36	70	360	25000	2100	205	AL	FT	52	305
420	370	150	510	440	150	590	510	150	700	610	150			20000	2700	290	AR	FT	100	390	2600	270	AR	FT	84	370	2350	245	AL	FT	64	335	20000	2050	205	AL	FT	48	280
340	290	120	410	350	120	470	410	120	560	480	120			15000	2700	305	AR	46	113	385	2400	270	AR	39	78	340	2150	250	AL	FT	61	315	15000	1800	205	AL	FT	44	260
250	220	90	300	260	90	350	310	90	420	360	90			10000	2700	305	AR	46	108	355	2500	285	AR	43	88	335	2400	270	AR	38	73	315	2150	250	AL	36	57	295	10000	1650	210	AL	FT	42	245
170	140	60	200	170	60	230	200	60	280	240	60			5000	2700	305	AR	46	103	330	2500	285	AR	43	82	310	2400	270	AR	38	66	290	2150	250	AL	36	54	275	5000	1600	210	AL	33	39	230
80	70	30	100	90	30	110	100	30	140	120	30			S. L.	2700	305	AR	46	98	310	2550	285	AR	43	77	290	2400	270	AR	38	63	270	2150	250	AL	36	48	250	S. L.	1600	200	AL	31	34	200

NOTES

① ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D

2. IF 85 GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9400 LB GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT AIRMILES AT 20,000 FT. ALT MAINTAIN 2350 RPM AND 245 MPH IND AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 44—Flight Operation Instruction Chart—V-1650-7 Engine (Wing Bomb Racks—9600 to 8000 lbs.)

MODEL(S): P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,000 TO 9500 POUNDS

EXTERNAL LOAD ITEMS

2 - 300-LB. WING BOMBS
(OR SMALLER SIZE)

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V			MAXIMUM RANGE					
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES								
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL							
MAXIMUM CONTINUOUS				OPERATING DATA			OPERATING DATA			OPERATING DATA												
R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.
				[1] 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT [2]																					
			269			40000													40000						
650		560	240	790		680	910		790	1070		930	269 240	1240		1080			35000						
						30000													30000						
590		510	220	720		620	840		730	990		850	220	1140		990									
540		470	200	650		570	760		660	890		770	200	1030		900									
480		420	180	590		510	680		590	800		690	180	930		810									
430		370	160	520		450	610		530	710		620	160	830		720									
380		330	140	460		400	530		460	620		540	140	730		630									
2700	270	AR	46	115	395	25000							2450	255	AR	41	86	375	25000	2100	200	AL	FT	53	295
2700	275	AR	FT	100	375	20000							2550	260	AR	FT	83	355	20000	2050	200	AL	FT	48	275
2700	290	AR	46	113	365	15000	2550	280	AR	FT	96	350	2400	260	AR	39	78	330	15000	1800	200	AL	FT	45	255
2700	290	AR	46	108	340	10000	2550	280	AR	43	89	325	2400	260	AR	38	72	305	10000	1650	205	AL	FT	42	240
2700	290	AR	46	103	315	5000	2550	275	AR	43	82	300	2400	260	AR	38	67	280	5000	1600	205	AL	33	39	225
2700	290	AR	46	98	295	S. L.	2500	275	AR	42	75	275	2400	260	AR	38	63	260	S. L.	1600	210	AL	33	37	210

NOTES

[1] ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLON FUSELAGE TANK IS INSTALLED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9800 LB GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2200 RPM AND 250 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 45—Flight Operation Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—10,000 to 9500 lbs.)

MODEL(S): P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9500 TO 8000 POUNDS

EXTERNAL LOAD ITEMS

2 - 300-LB. WING BOMBS (OR SMALLER SIZE)

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			II		III		IV		V	
RANGE IN AIR MILES		FUEL U. S. GAL.	RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES		FUEL U. S. GAL.	RANGE IN AIR MILES
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE / NAUTICAL
		184	1 24 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ①						184	
430	370	160	500	430	600	520	720	620	160	850 / 740
380	330	140	440	380	530	460	630	540	140	740 / 650
320	280	120	380	330	450	390	540	460	120	640 / 550
270	230	100	310	270	380	330	450	390	100	530 / 460
210	180	80	250	220	300	260	360	310	80	430 / 370
160	140	60	190	160	220	190	270	230	60	320 / 280
110	90	40	120	110	150	130	180	150	40	220 / 190
50	40	20	60	50	70	60	90	70	20	110 / 100

MAXIMUM CONTINUOUS						ALT. Feet	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT. Feet	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.		R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.		R. P. M.	I. A. S. M.P.H.	MIXTURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2700	270	AR	46	115	395	25000							2450	255	AR	41	89	375	2400	240	AR	37	71	355	25000	2100	205	AL	FT	52	305
2700	275	AR	FT	100	375	20000							2550	260	AR	FT	84	355	2400	240	AL	FT	66	330	20000	2050	205	AL	FT	49	285
2700	290	AR	46	113	365	15000	2550	280	AR	FT	100	350	2400	260	AR	39	79	330	2200	245	AL	FT	62	310	15000	1800	205	AL	FT	45	260
2700	290	AR	46	108	340	10000	2550	280	AR	43	93	325	2400	260	AR	38	73	305	2250	250	AL	36	58	290	10000	1650	210	AL	FT	42	245
2700	290	AR	46	103	315	5000	2550	280	AR	43	86	300	2400	260	AR	38	67	280	2250	250	AL	36	54	270	5000	1600	210	AL	33	40	230
2700	290	AR	46	98	295	S. L.	2550	280	AR	43	80	280	2400	260	AR	38	62	260	2250	250	AL	36	50	250	S. L.	1600	210	AL	32	37	210

NOTES

① ALLOW 24 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND RESERVE & COMBAT AS REQ'D

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9300 LB GROSS WT. WITH 160 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 GAL.) TO FLY 550 STAT AIRMILES AT 10,000 FT. ALT MAINTAIN 2250 RPM AND 250 MPH IND AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 46—Flight Operation Instruction Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—9500 to 8000 lbs.)

MODEL(S): P-51D

FLIGHT OPERATION INSTRUCTION CHART

EXTERNAL LOAD ITEMS: 2 - 500-LB. WING BOMBS

ENGINE(S): V-1650-7

CHART WEIGHT LIMITS: 10,500 TO 10,000 POUNDS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW / HIGH	AR	5	194 / 167
MILITARY POWER	3000	61	LOW / HIGH	AR	15	178 / 170
NORMAL RATED	2700	46	LOW / HIGH	AR	CONT.	108 / 105

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
				1 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT D												
630	*540*		269 240	760	*660*		870	*760*		1020	*890*		269 240	1180	*1020*	
570	*500*		220	700	*610*		800	*690*		940	*810*		220	1080	*940*	
520 470	*450* *410*		200 180	640 570	*550* *500*		730 650	*630* *570*		850 770	*740* *680*		200 180	980 880	*850* *770*	
420 370	*360* *320*		160 140	510 440	*440* *390*		580 510	*500* *440*		680 600	*590* *520*		160 140	790 690	*680* *600*	

MAXIMUM CONTINUOUS						ALT.	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT.	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000 35000 30000																			40000 35000 30000						
2700	260	AR	46	115	385	25000							2500	245	AR	41	91	365	2400	235	AR	38	73	345	25000	2150	200	AL	FT	55	295
2700	265	AR	FT	100	360	20000							2600	255	AR	FT	87	350	2450	240	AR	FT	69	325	20000	2100	200	AL	FT	51	275
2700	280	AR	46	113	355	15000	2550	270	AR	FT	95	340	2400	255	AR	FT	80	325	2250	240	AL	36	65	305	15000	1900	205	AL	FT	48	260
2700	280	AR	46	108	330	10000	2500	270	AR	42	89	315	2400	255	AR	39	73	300	2300	245	AL	36	61	285	10000	1650	210	AL	FT	46	245
2700	280	AR	46	103	305	5000	2500	270	AR	42	82	290	2400	255	AR	38	67	275	2350	245	AL	36	56	265	5000	1600	210	AL	36	43	230
2700	280	AR	46	98	285	S. L.	2500	270	AR	42	76	270	2400	255	AR	38	63	255	2350	245	AL	36	52	245	S. L.	1600	210	AL	34	41	210

NOTES

① ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

EXAMPLE

AT 10,300 LB. GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 950 STAT AIRMILES AT 10,000 FT. ALT. MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

HIGH BLOWER ABOVE HEAVY LINE ONLY.

Figure 47—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,500 to 10,000 lbs.)

MODEL(S) P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,000 TO 8500 POUNDS

EXTERNAL LOAD ITEMS

2 - 500-LB. WING BOMBS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
420	*360*		184	① 24 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT									184	800	*740*	
370	*320*		160 140	500	*430*		580	*500*		680	*590*		160 140	700	*610*	
310	*270*		120	370	*320*		430	*380*		510	*440*		120	600	*520*	
260	*230*		100	310	*270*		360	*310*		420	*370*		100	500	*440*	
210	*180*		80	250	*210*		290	*250*		340	*290*		80	400	*350*	
150	*130*		60	180	*160*		210	*190*		250	*220*		60	300	*270*	
100	*90*		40	120	*110*		140	*120*		170	*140*		40	200	*180*	
50	*40*		20	60	*50*		70	*60*		80	*70*		20	100	*90*	

MAXIMUM CONTINUOUS						ALT.	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT.	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000 35000 30000																			40000 35000 30000						
2700	260	AR	46	115	385	25000							2450	245	AR	41	90	365	2400	235	AR	37	73	345	25000	2150	200	AL	FT	54	300
2700	270	AR	FT	100	365	20000							2550	255	AR	FT	85	345	2400	240	AL	FT	68	325	20000	2100	205	AL	FT	50	280
2700	280	AR	46	113	355	15000	2500	265	AR	FT	97	335	2400	255	AR	38	79	320	2250	240	AL	36	64	305	15000	1850	205	AL	FT	47	260
2700	280	AR	46	108	330	10000	2500	265	AR	42	89	310	2400	255	AR	38	73	295	2300	245	AL	36	60	285	10000	1700	210	AL	FT	44	245
2700	280	AR	46	103	305	5000	2500	270	AR	42	83	290	2400	255	AR	39	68	275	2350	245	AL	36	56	265	5000	1600	210	AL	35	42	230
2700	280	AR	46	98	285	S. L.	2550	270	AR	43	78	270	2400	255	AR	39	63	255	2350	245	AL	36	52	245	S. L.	1600	210	AL	34	39	210

NOTES

① ALLOW 24 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 9800 LB. GROSS WT. WITH 160 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 GAL.) TO FLY 600 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 48—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,000 to 8500 lbs.)

MODEL(S): P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,700 TO 9600 POUNDS

EXTERNAL LOAD ITEMS

2 - 75-GALLON COMBAT TANKS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	① 3000	67	LOW HIGH	AR	5	194 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I						FUEL	II						III						IV						FUEL	V					
RANGE IN AIR MILES						U. S.	RANGE IN AIR MILES						RANGE IN AIR MILES						RANGE IN AIR MILES						U. S.	RANGE IN AIR MILES					
STATUTE		NAUTICAL				GAL.	STATUTE		NAUTICAL				STATUTE		NAUTICAL				STATUTE		NAUTICAL				GAL.	STATUTE		NAUTICAL			
							① 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ①																									
1000		*870*				419 390	1210		*1050*				1410		*1230*				*1610*		1400				419 390	1820		*1580*			
920		*800*				360	1120		*970*				1310		*1130*				1490		*1290*				360	1680		*1460*			
850		*730*				330	1020		*890*				1200		*1040*				1360		*1180*				330	1540		*1330*			
770		*670*				300	930		*800*				1090		*940*				1240		*1070*				300	1400		*1210*			
690		*600*				270	830		*720*				980		*850*				1110		*960*				270	1260		*1090*			
610		*530*				240	740		*640*				870		*750*				990		*860*				240	1120		*970*			
MAXIMUM CONTINUOUS							OPERATING DATA						OPERATING DATA						OPERATING DATA							MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
2700	245	AR	FT	105	390	30000							2600	235	AR	FT	93	375	2500	225	AR	FT	78	360	30000	2400	195	AL	FT	61	315
2700	255	AR	46	115	375	25000							2400	235	AR	FT	87	350	2400	230	AR	37	74	340	25000	2200	200	AL	FT	57	295
2700	260	AR	FT	100	355	20000							2550	250	AR	FT	84	340	2400	230	AL	FT	69	315	20000	2150	200	AL	FT	54	275
2700	275	AR	46	113	345	15000	2500	260	AR	FT	96	330	2400	250	AR	39	78	315	2250	240	AL	36	65	300	15000	2000	210	AL	FT	52	265
2700	275	AR	46	108	320	10000	2500	260	AR	42	89	305	2400	250	AR	38	72	290	2300	240	AL	36	61	280	10000	1750	210	AL	FT	48	245
2700	275	AR	46	103	300	5000	2500	265	AR	42	83	285	2400	250	AR	38	67	270	2300	240	AL	36	57	260	5000	1600	205	AL	36	44	225
2700	275	AR	46	98	280	S. L.	2550	265	AR	43	75	265	2400	250	AR	38	62	250	2300	240	AL	36	52	240	S. L.	1600	200	AL	34	39	200

NOTES

① ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO COMBAT TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

AT 10,500 LB. GROSS WT. WITH 390 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1500 STAT. AIRMILES AT 25,000 FT. ALT. MAINTAIN 2400 RPM AND 230 MPH IND. AIRSPEED WITH MIXTURE SET AUTO RICH - HIGH BLOWER.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 49—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—10,700 to 9600 lbs.)

MODEL(S): P-51D

ENGINE(S): V-1650-7

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9600 TO 8000 POUNDS

EXTERNAL LOAD ITEMS: 2 - 75-GALLON COMBAT TANKS

LIMITS	R. P. M.	M. P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.
WAR MAX.	3000	67	LOW HIGH	AR	5	195 187
MILITARY POWER	3000	61	LOW HIGH	AR	15	178 170
NORMAL RATED	2700	46	LOW HIGH	AR	CONT.	109 106

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

I			FUEL	II			III			IV			FUEL	V		
RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES			RANGE IN AIR MILES			RANGE IN AIR MILES			U. S.	RANGE IN AIR MILES		
STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL		STATUTE	NAUTICAL		STATUTE	NAUTICAL		GAL.	STATUTE	NAUTICAL	
				① 29 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT ①												
610	530		269	740	640		860	750		1040	900		269	1180	1020	
540	470		240 210	650	560		750	650		910	790		240 210	1030	890	
460	400		180	560	480		640	560		780	670		180	880	770	
380	330		150	460	400		540	460		650	560		150	740	640	
310	270		120	370	320		430	370		520	450		120	590	510	
230	200		90	280	240		320	280		390	340		90	450	390	
150	130		60	180	160		210	180		260	220		60	300	260	
70	60		30	90	80		100	90		130	110		30	150	130	

MAXIMUM CONTINUOUS						ALT.	OPERATING DATA						OPERATING DATA						OPERATING DATA						ALT.	MAXIMUM RANGE					
R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.
						40000																			40000						
						35000																			35000						
2700	245	AR	FT	105	390	30000							2600	235	AR	FT	94	375	2500	225	AR	FT	75	360	30000	2350	190	AL	FT	57	310
2700	255	AR	46	115	375	25000							2450	240	AR	41	89	355	2400	225	AR	37	70	335	25000	2150	190	AL	FT	53	285
2700	260	AR	FT	100	355	20000							2550	250	AR	FT	85	340	2350	225	AL	FT	65	310	20000	2050	195	AL	FT	49	265
2700	275	AR	46	113	345	15000	2550	260	AR	FT	96	330	2400	250	AR	39	79	315	2200	235	AL	FT	62	295	15000	1850	200	AL	FT	46	250
2700	275	AR	46	108	320	10000	2550	260	AR	43	89	305	2400	250	AR	38	73	290	2150	235	AL	36	57	275	10000	1650	200	AL	FT	44	235
2700	275	AR	46	103	300	5000	2550	265	AR	43	83	285	2400	250	AR	38	68	270	2150	235	AL	36	53	255	5000	1600	200	AL	34	41	220
2700	275	AR	46	98	280	S. L.	2550	265	AR	43	77	265	2400	250	AR	38	63	250	2150	235	AL	36	49	235	S. L.	1600	205	AL	34	38	205

NOTES

① ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

2. IF 88-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 90 GALLONS ARE USED BEFORE SWITCHING TO COMBAT TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

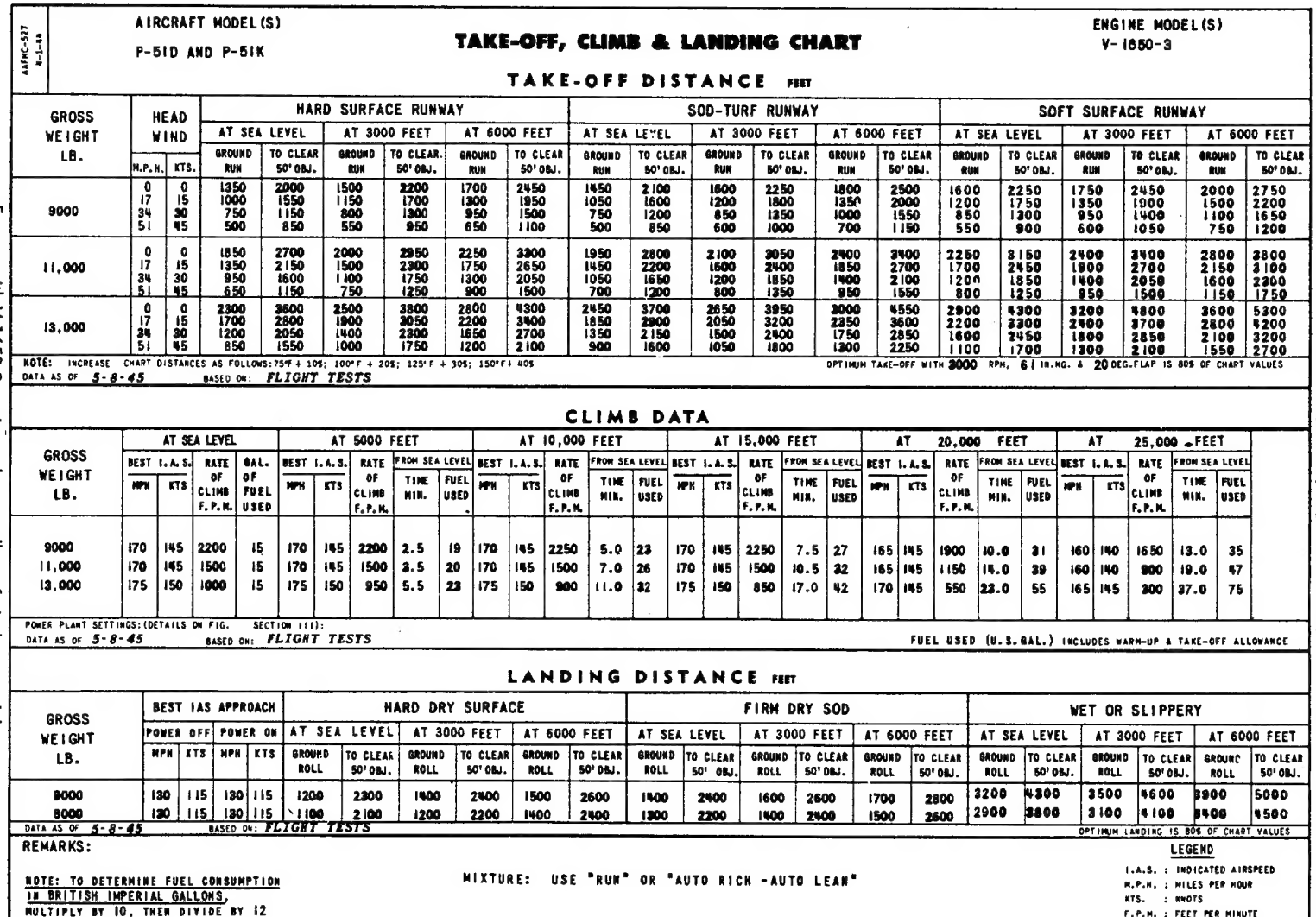
AT 9500 LB. GROSS WT. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 950 STAT. AIRMILES AT 20,000 FT. ALT. MAINTAIN 2350 RPM AND 225 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

LEGEND

I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL
F. T.: FULL THROTTLE
F. R.: FULL RICH
A. R.: AUTO-RICH
A. L.: AUTO-LEAN
C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 50—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—9600 to 8000 lbs.)



AIRCRAFT MODEL(S)
P-51D AND P-51K

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
V-1650-3

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3000 FEET GROUND RUN	SOD-TURF RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6000 FEET GROUND RUN	SOD-TURF RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 3000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
9000	0	0	1350	2000	1500	2200	1700	2450	1450	2100	1600	2250	1800	2500	1600	2250	1750	2450	2000	2750
	17	15	1000	1550	1150	1700	1300	1950	1050	1600	1200	1800	1350	2000	1200	1750	1350	1900	1500	2200
	34	30	750	1150	800	1300	950	1500	750	1200	850	1350	1000	1550	850	1300	950	1400	1100	1650
	51	45	500	850	550	950	650	1100	500	850	600	1000	700	1150	550	900	600	1050	750	1200
11,000	0	0	1850	2700	2000	2950	2250	3300	1950	2800	2100	3050	2400	3400	2250	3150	2400	3400	2800	3800
	17	15	1350	2150	1500	2300	1750	2650	1450	2200	1600	2400	1850	2700	1700	2450	1900	2700	2150	3100
	34	30	950	1600	1100	1750	1300	2050	1050	1650	1200	1850	1400	2100	1200	1850	1400	2050	1600	2300
	51	45	650	1150	750	1250	900	1500	700	1200	800	1350	950	1550	800	1250	950	1500	1150	1750
13,000	0	0	2300	3600	2500	3800	2800	4300	2450	3700	2650	3950	3000	4550	2900	4300	3200	4800	3600	5300
	17	15	1700	2800	1900	3050	2200	3400	1850	2900	2050	3200	2350	3600	2200	3300	2400	3700	2800	4200
	34	30	1200	2050	1400	2300	1650	2700	1350	2150	1500	2400	1750	2850	1600	2450	1800	2850	2100	3200
	51	45	850	1550	1000	1750	1200	2100	900	1600	1050	1800	1300	2250	1100	1700	1300	2100	1550	2700

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F+ 40%

OPTIMUM TAKE-OFF WITH 3000 RPM, 61 IN.MG. & 20 DEG.FLAP IS 80% OF CHART VALUES

DATA AS OF 5-8-45 BASED ON: FLIGHT TESTS

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL BEST I.A.S. MPH	AT SEA LEVEL BEST I.A.S. KTS	AT SEA LEVEL RATE OF CLIMB F.P.M.	AT SEA LEVEL GAL. OF FUEL USED	AT 5000 FEET BEST I.A.S. MPH	AT 5000 FEET BEST I.A.S. KTS	AT 5000 FEET RATE OF CLIMB F.P.M.	AT 5000 FEET FROM SEA LEVEL TIME MIN.	AT 5000 FEET FROM SEA LEVEL FUEL USED	AT 10,000 FEET BEST I.A.S. MPH	AT 10,000 FEET BEST I.A.S. KTS	AT 10,000 FEET RATE OF CLIMB F.P.M.	AT 10,000 FEET FROM SEA LEVEL TIME MIN.	AT 10,000 FEET FROM SEA LEVEL FUEL USED	AT 15,000 FEET BEST I.A.S. MPH	AT 15,000 FEET BEST I.A.S. KTS	AT 15,000 FEET RATE OF CLIMB F.P.M.	AT 15,000 FEET FROM SEA LEVEL TIME MIN.	AT 15,000 FEET FROM SEA LEVEL FUEL USED	AT 20,000 FEET BEST I.A.S. MPH	AT 20,000 FEET BEST I.A.S. KTS	AT 20,000 FEET RATE OF CLIMB F.P.M.	AT 20,000 FEET FROM SEA LEVEL TIME MIN.	AT 20,000 FEET FROM SEA LEVEL FUEL USED	AT 25,000 FEET BEST I.A.S. MPH	AT 25,000 FEET BEST I.A.S. KTS	AT 25,000 FEET RATE OF CLIMB F.P.M.	AT 25,000 FEET FROM SEA LEVEL TIME MIN.	AT 25,000 FEET FROM SEA LEVEL FUEL USED
9000	170	145	2200	15	170	145	2200	2.5	19	170	145	2250	5.0	23	170	145	2250	7.5	27	165	145	1900	10.0	31	160	140	1650	13.0	35
11,000	170	145	1500	15	170	145	1500	3.5	20	170	145	1500	7.0	26	170	145	1500	10.5	32	165	145	1150	14.0	39	160	140	900	19.0	47
13,000	175	150	1000	15	175	150	950	5.5	23	175	150	900	11.0	32	175	150	850	17.0	42	170	145	550	22.0	55	165	145	300	37.0	75

POWER PLANT SETTINGS: (DETAILS ON FIG. SECTION III):

DATA AS OF 5-8-45 BASED ON: FLIGHT TESTS

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH POWER OFF MPH	POWER OFF KTS	POWER ON MPH	POWER ON KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3000 FEET GROUND ROLL	HARD DRY SURFACE AT 3000 FEET TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6000 FEET GROUND ROLL	HARD DRY SURFACE AT 6000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3000 FEET GROUND ROLL	FIRM DRY SOD AT 3000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6000 FEET GROUND ROLL	FIRM DRY SOD AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3000 FEET GROUND ROLL	WET OR SLIPPERY AT 3000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6000 FEET GROUND ROLL	WET OR SLIPPERY AT 6000 FEET TO CLEAR 50' OBJ.
9000	130	115	130	115	1200	2300	1400	2400	1500	2600	1400	2400	1600	2600	1700	2800	3200	4300	3500	4600	3900	5000
8000	130	115	130	115	1100	2100	1200	2200	1400	2400	1300	2200	1400	2400	1500	2600	2900	3800	3100	4100	3400	4500

DATA AS OF 5-8-45 BASED ON: FLIGHT TESTS

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

MIXTURE: USE "RUN" OR "AUTO RICH - AUTO LEAN"

LEGEND
I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure 64—Take-off, Climb and Landing Chart

For use with V-1650-3 engine only regardless of airplane model.

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